

FLATHEAD COUNTY

TRAFFIC SAFETY IMPROVEMENT STUDY

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FLATHEAD COUNTY TRAFFIC SAFETY
IMPROVEMENT STUDY

Prepared For:

FLATHEAD COUNTY

In Cooperation With:

MONTANA DEPARTMENT OF JUSTICE,
HIGHWAY TRAFFIC SAFETY DIVISION

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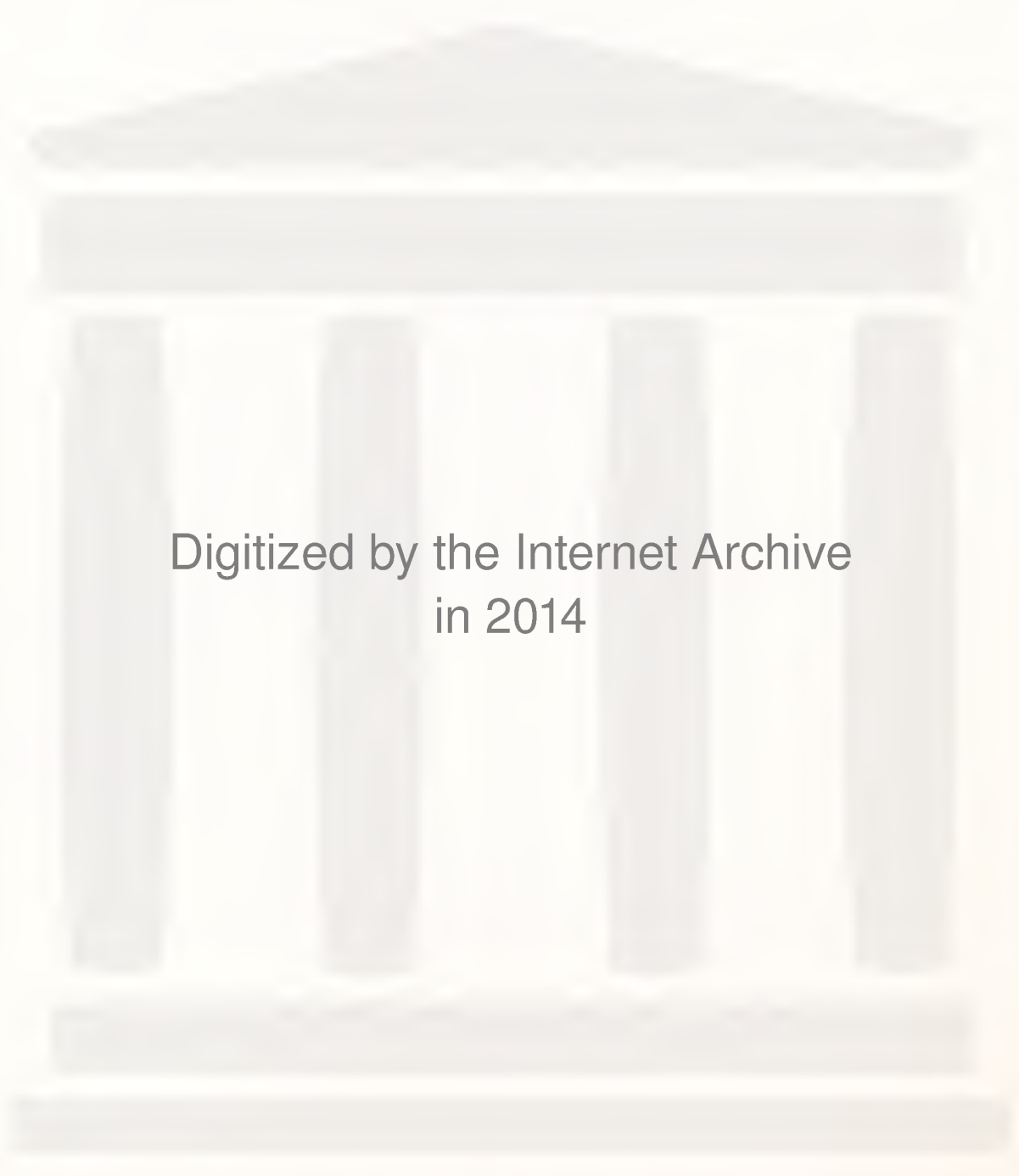
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September, 1988



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CHAPTER I

INTRODUCTION

A. PURPOSE

The purpose of this report is to analyze the cause of accidents at locations on the county road system where accident reports indicate a cluster of accidents, and to develop an improvement plan for those locations.

B. COUNTY ROAD ACCIDENT HISTORY

The road system in Flathead County can be divided into three categories:

- 1) on-system roads which are part of the Federal Aid Highway System and are under the jurisdiction of the Montana Department of Highways;
- 2) off-system roads that come under the jurisdiction of federal agencies such as the Forest Service, Park Service, or Bureau of Indian Affairs; and

- 3) off-system roads that come under the jurisdiction of Flathead County.

This study covers the roads in category 3.

The Flathead County rural road system has 2,328 miles of road, of which 1,738 miles are dirt or gravel surfaced and 590 miles are paved. The average road mileage for the 56 counties in Montana is 1,343 miles with an average of 1,099 miles with dirt or gravel surfaces and 244 miles paved. Flathead County has 73 percent more county road than the average county in the state, ranking third in the state in the number of road miles under county jurisdiction.

During the four-year period from January 1984 through December 1987, 6,287 reported accidents occurred in Flathead County. These accidents resulted in 3,399 injuries and 72 fatalities. Accidents on the road system under jurisdiction of Flathead County accounted for 3,079 reported accidents with 1,698 injuries and 18 fatalities.

The 1985 estimated population of Flathead County was 57,300. During the four-year period from 1984 through 1987, Flathead County had 0.054 accidents per person. The county ranks 28th in the state in accidents per capita.

C. COUNTY ACCIDENT LOCATIONS

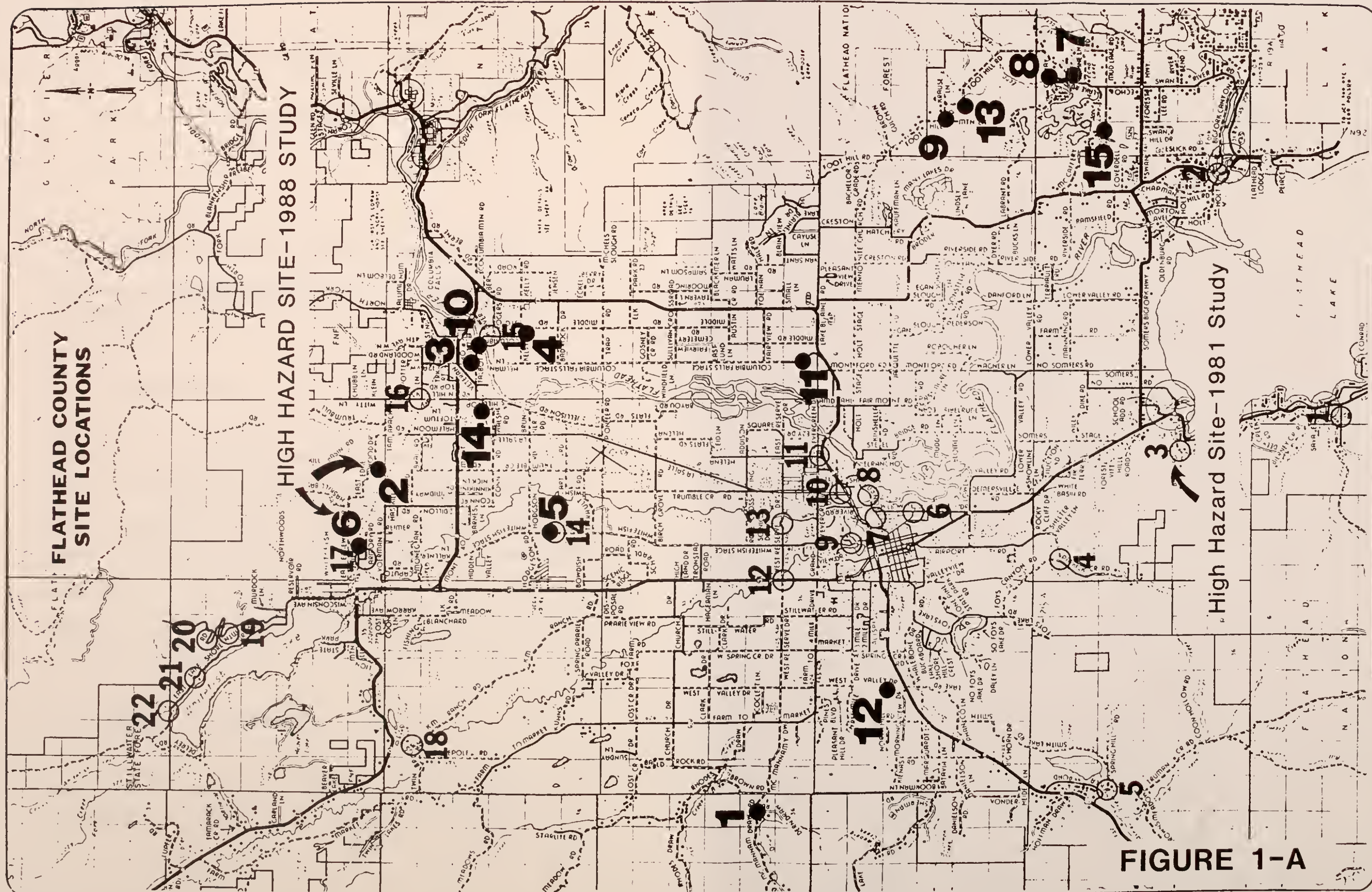
The Department of Justice maintains records of all reported accidents in the state. The consultant tabulated the accidents on the county road system by location. Locations with clusters of accidents were analyzed to arrive at 15 locations where a detailed analysis was carried out. Based on the analysis, short- and long-term improvements were developed for each site. Chapter II explains the study methods in detail. The locations of the sites are shown on Figure 1A on the following page.

**FLATHEAD COUNTY
SITE LOCATIONS**

HIGH HAZARD SITE-1988 STUDY

High Hazard Site-1981 Study

FIGURE 1-A



CHAPTER II

STUDY METHODS

The determination of improvements required to reduce accidents at the selected sites involves eight basic steps. These are outlined in the following sections.

A. ACCIDENT ANALYSIS

Department of Justice records were used to obtain the accident reports at each of the selected sites. The accident reports were reviewed and pertinent information was plotted on a preliminary sketch of each location. This information included: a symbolic sketch showing vehicle paths, point of collision, collision type, time of day, road condition, and number of injuries or fatalities. The sketches were used to determine trends and patterns.

B. PRELIMINARY FIELD SURVEY

The consultant prepared a list of 36 sites based on the location of accident clusters. These were reviewed with the Highway Traffic Safety

Division, Traffic Engineer, and the Flathead County Road Superintendent. The list was reduced to 15 new sites and three sites from the 1981 High Hazard Location Study. A detailed survey was made at these sites.

C. DETAILED FIELD SURVEY

A two-man survey crew visited each site to collect detailed data. The following information was collected:

1. Site Survey

Each site was surveyed so that an accurate plan of the site could be prepared showing roadway alignment, grades, superelevations, and other physical characteristics. Surrounding topography was also surveyed showing sign and other traffic control device locations, fences, utility poles, trees, and other roadside objects. The survey was extended to take in all features which could have an effect on the road user such as background roads that appear to be an extension of the roadway or utility lines or waterways which continue straight while the roadway turns. These features sometimes create driver expectancy resulting in off-road accidents.

2. Traffic Counts

Peak hours (4:00 p.m. to 6:00 p.m.) turning movement counts were made at 15 of the sites. The peak hour traffic count was converted to average daily traffic using a peak hour factor. The permanent mechanical traffic counter on Big Mountain Road was used to determine the average daily traffic for that site.

3. Sight Distance

The driver sight distance on all approaches at each site was measured.

4. Safe Speed Study

A ball bank indicator was used to determine the safe speed on horizontal curves. This instrument measures the overturning force on a vehicle and limits at which riding discomfort and loss of vehicle control begin.

5. Driver Expectancy and Information System Evaluation

Each member of the survey crew independently rated the driver expectancy and informational system of each site.

Driver expectancy is a measure of a driver's perception of the roadway and the amount of time a driver has to react and take the necessary actions to pass safely through the location. The rating ranges from no unexpected or unusual actions required to very unusual situations which would surprise many unfamiliar drivers.

The information system evaluation consisted of determining if the roadway design and traffic control devices were sufficient to give the driver the information required in sufficient time to take the necessary actions to safely negotiate the location. Ratings for the information system range from easy and obvious information interpretation to the lack of important information.

The evaluation forms used for the driver expectancy and information system evaluation are shown in Figures 1 and 2.

6. Site Sketches

The field survey data was used to prepare a sketch of each site showing the pertinent features. These include alignment, grade, roadway dimensions, approaches, ditches, foliage, roadside objects, traffic control devices, surface type and condition, sight distance and surrounding features that may affect the function of the roadway. The sketches have been used as a base to show the existing conditions, accident dia-

grams and recommended improvements contained in the site analysis section of this report (Chapter IV).

D. CALCULATE HAZARD INDEX

A hazard index was calculated for each site. The hazard index calculation form along with the various indicator values are shown in Figures 3 through 10. The factors entering into the hazard index calculation are as follows: (all figures and tables are at the end of this chapter)

1. Number of Accidents

The average annual number of accidents for the four-year period from 1984 through 1987 was used to calculate this indicator (see Figure 3).

2. Accident Rate

The accident rate is expressed in accidents per million vehicle miles of travel. The average daily traffic (ADT) as determined from the peak hour turning movement counts were used to compute this indicator (see Figure 4).

3. Accident Severity

Accident severity relates property damages, bodily injuries and fatalities to dollar costs. The unit costs shown in Figure 5 were used to calculate this indicator (see Figure 5 and Table 3).

4. Volume/Capacity Ratio

The 1987 average daily traffic and the 24-hour capacity (Level of Service) as calculated using the methods set forth in the 1985 Highway Capacity Manual were used to calculate this indicator (see Figure 6).

5. Sight Distance

Sight distances on all approaches were determined by the field survey. This was related to the required stopping distance to determine the indicator value of each location (see Figure 7).

6. Driver Expectancy Problems and Information System Deficiencies

The average rating values from the two independent field ratings were used to determine the values for these two indicators (see Figures 1, 2, 8, and 9).

7. Hazard Index

The hazard index for each site was calculated by combining the seven hazard rating indices. The hazardousness of each location was used to rank the sites.

E. DEVELOP RECOMMENDED IMPROVEMENT PLANS

A recommended improvement plan has been developed based on the layout sketch, accident analysis, field notes, traffic volumes and movements, photos, site inspections, and local interviews. The improvements are shown on the location sketch for each site contained in Chapter IV.

Recommended improvements have been separated into two categories:

- * Short-Range Improvements, which consist of traffic control and minor geometric modifications.
- * Long-Range Improvements, including items such as major changes in alignment, reconstruction, new construction, or recommendations related to future development in the area.

F. COSTS

Costs provided by the Montana Department of Highways as approved by the Federal Highway Administration will be paid to the county under a "Work at Agreed Price" contract. The approved costs have been used to determine improvement costs at each site. The costs are shown in Table 4.

The costs in Table 4 are used to determine the cost factor which is the improvement cost per vehicle entering the site over a five-year period. The five-year period represents the reasonable design life of the improvements.

Figure 10 is used to determine the cost factor for each site.

G. CALCULATE PRIORITY INDEX

The priority index is determined by combining the hazard index and the cost index. The hazard index is given a 75 percent weight and the cost index is weighted 25 percent. These calculations are shown in Chapter IV. The priority index is used to rank each site as shown in the priority listing in Chapter III.

TABLE 2

SAFETY PROJECT COSTS - APPROVED BY FHWA, MARCH 6, 1988

A. Signs

1)	1 square foot to 6 square feet	\$ 100.00
2)	6.1 square feet to 10 square feet	140.00
3)	10.1 square feet to 20 square feet	170.00

B. Delineators

1)	Design "A" metal posts	\$ 9.25
2)	Design "A" flexible posts - 6'	20.00
3)	Design "A" flexible posts - 27"	6.00

C. Guardrail

1)	New "W" beam rail	\$ 8.00 per foot
2)	"W" beam end treatment incl. anchor	1,000.00 each
3)	New concrete rail	16.00 per foot
4)	Concrete end tapers	16.00 per foot

H. BENEFIT/COST ANALYSIS

The Montana Department of Highways calculates the Benefit/Cost Ratio of safety improvements in order to set priorities for on-system projects. The Benefit/Cost Ratio for each site has been calculated using the MDOH method.

Figure 1

DRIVER EXPECTANCY PROBLEMS RATING FORM

Ratings

- 0 -- Nothing expected or unusual at this location.
 Actions required (if any) entirely consistent with
 driving strategy on approach.
 Standard geometry, with pathway(s) for intended
 movement(s) clearly evident.
 No interferences by other traffic likely.
- 1 --
- 2 --
- 3 -- Situation somewhat unexpected.
 Driver must be alert, but should be able to respond
 adequately at "last minute" to most combinations or
 adverse circumstances.
 Some initial confusion on intended path(s) or movements(s).
 Interference from other traffic may create some degree of
 confusion or uncertainty for average driver.
- 4 --
- 5 --
- 6 -- Very unusual situation; will "surprise" many unfamiliar
 drivers.
 Driver required to make major change in driving tactics
 from those employed over past few miles.
 At least a "near accident" almost expected if driver is
 even moderately inattentive; evasive actions likely to
 be required.
 Intended pathway(s) confusing under fairly normal traffic
 or lighting conditions.
 Other traffic, or lack of it, aggravates situation and
 misleads driver or deprives him of important cues.

Approach

	<u>Rating</u>						
	0	1	2	3	4	5	6
A	x-----	x-----	x-----	x-----	x-----	x-----	x-----
B	x-----	x-----	x-----	x-----	x-----	x-----	x-----
C	x-----	x-----	x-----	x-----	x-----	x-----	x-----
D	x-----	x-----	x-----	x-----	x-----	x-----	x-----

Figure 2

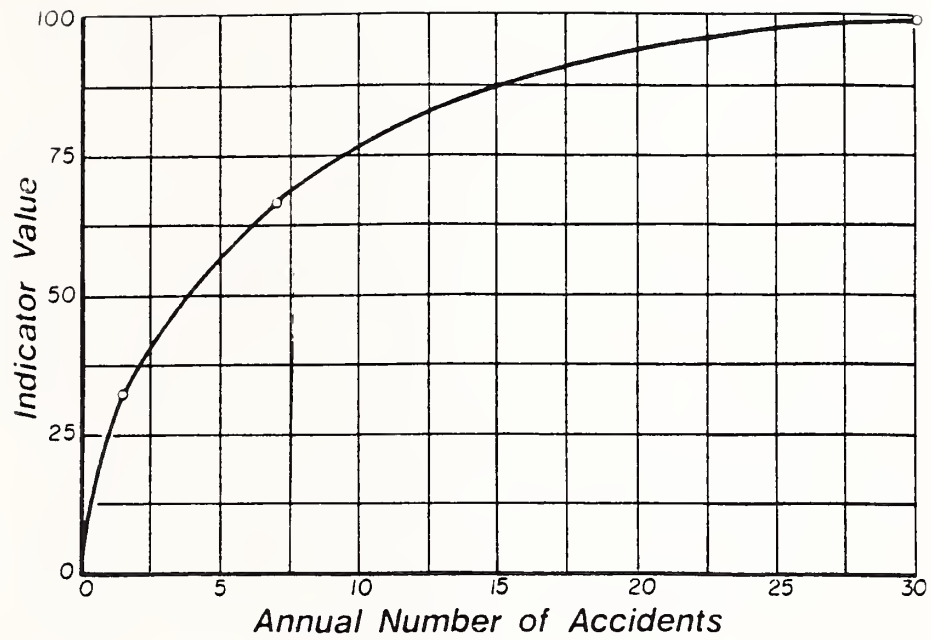
INFORMATION SYSTEM DEFICIENCIES RATING FORM

Ratings

- 0 -- Information for required decisions complete and ambiguous.
Signs, markings, delineation in good repair, clean, highly visible.
"Positive guidance" leads driver to appropriate path; makes error difficult.
Approach speeds of most drivers are appropriate.
Light decision load; easy, and obvious.
- 1 --
- 2 --
- 3 -- Some information lacking or somewhat misleading.
Signs should be moved or augmented for better visibility or to provide more decision time.
Visibility of signs, markings, and delineation barely adequate.
Advisory speed information should be changed slightly, or added.
Medium decision load; average driver will be able to handle situation, but may be a little uncomfortable.
- 4 --
- 5 --
- 6 -- Important information missing.
Complete new "information system" needed -- design and installation.
Present signs and markings in very poor condition; need replacement.
Speed limit and/or advisory speed needed; either missing or totally inappropriate at present.
"Positive guidance" on appropriate path lacking; a clutter of negative delineation only.
Heavy decision load; complete attention of average driver required; a "tense" situation at best.

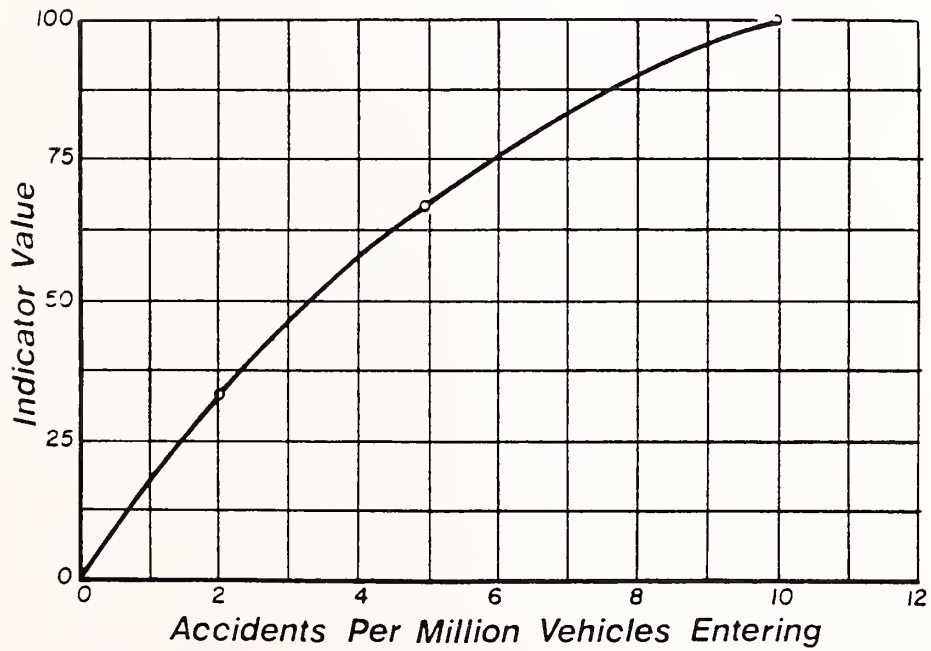
Approach

	<u>Rating</u>						
	0	1	2	3	4	5	6
A	x-----x-----x-----x-----x-----x-----x-----x						
B	x-----x-----x-----x-----x-----x-----x-----x						
C	x-----x-----x-----x-----x-----x-----x-----x						
D	x-----x-----x-----x-----x-----x-----x-----x						



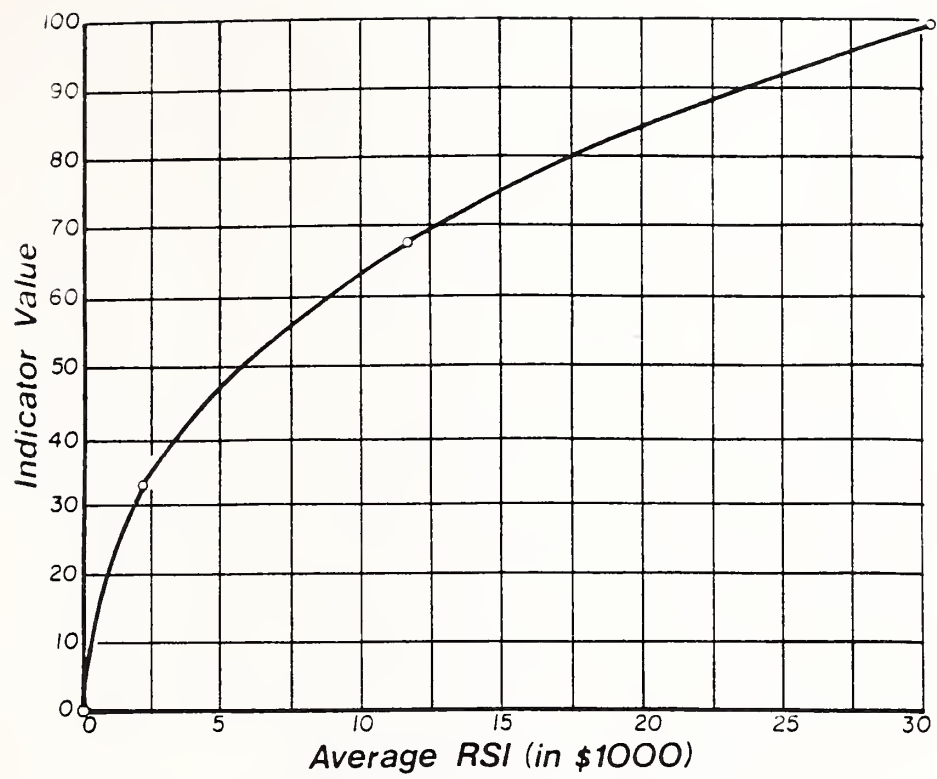
**INDICATOR VALUES FOR NUMBER
OF ACCIDENTS**

Figure 3



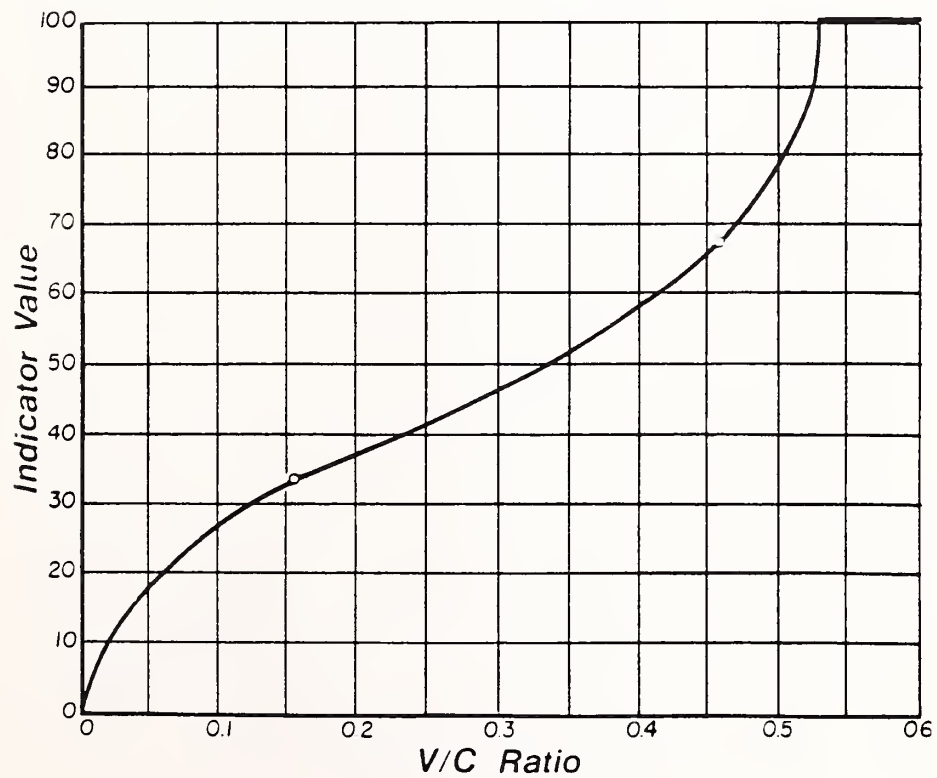
**INDICATOR VALUES FOR
ACCIDENT RATE**

Figure 4



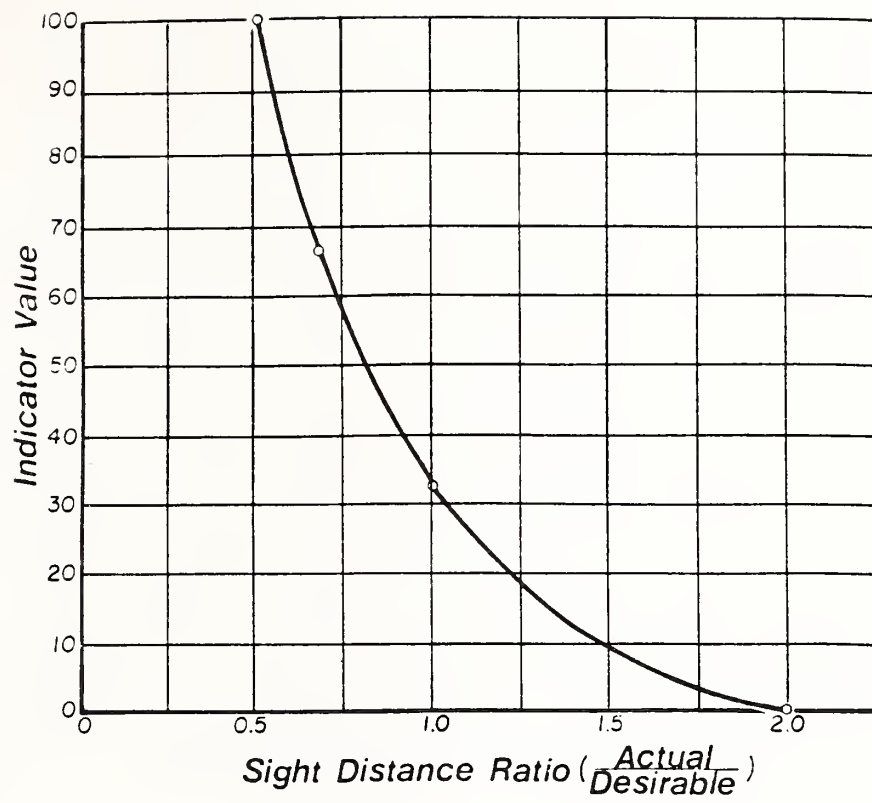
**INDICATOR VALUE FOR
ACCIDENT SEVERITY**

Figure 5



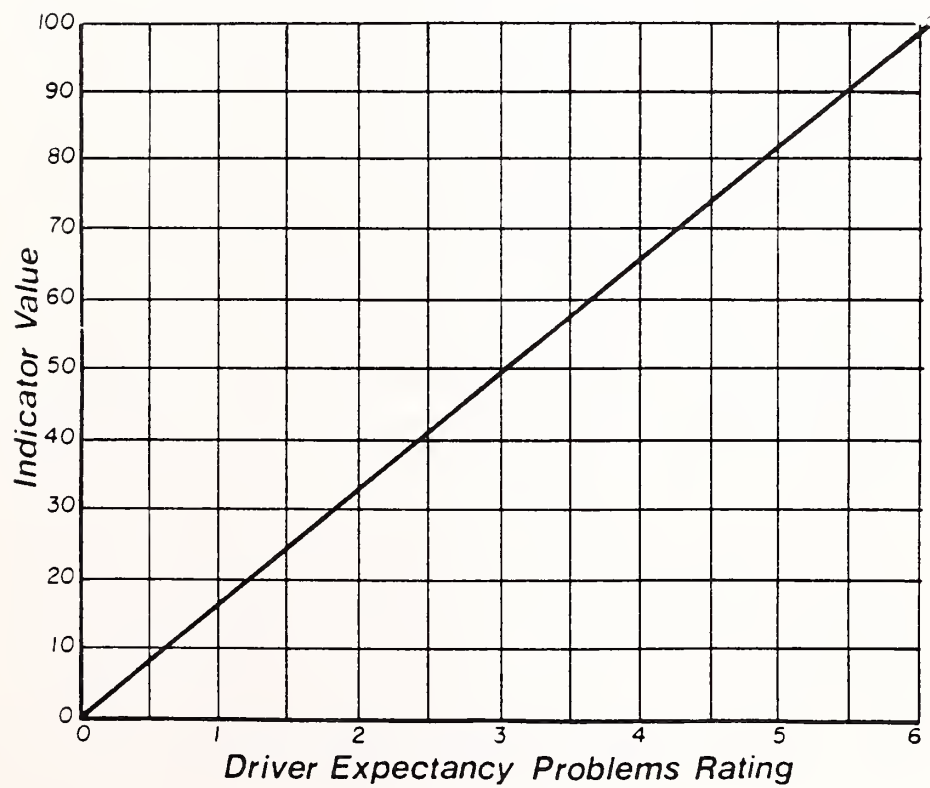
**INDICATOR VALUES FOR
V/C RATIO**

Figure 6



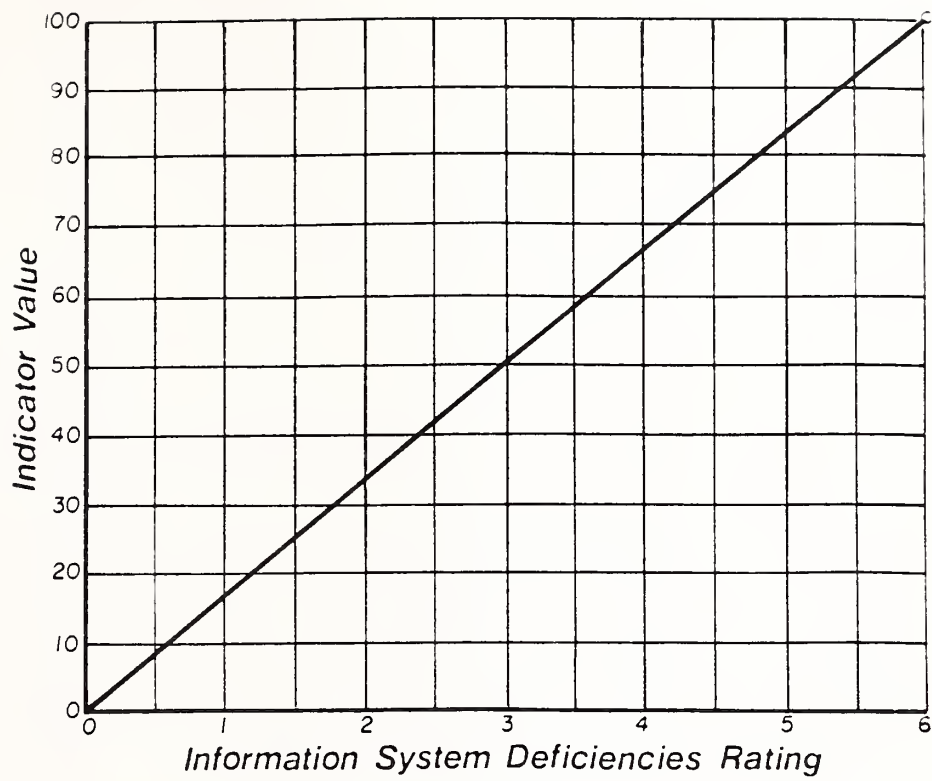
**INDICATOR VALUES FOR
SIGHT DISTANCE**

Figure 7



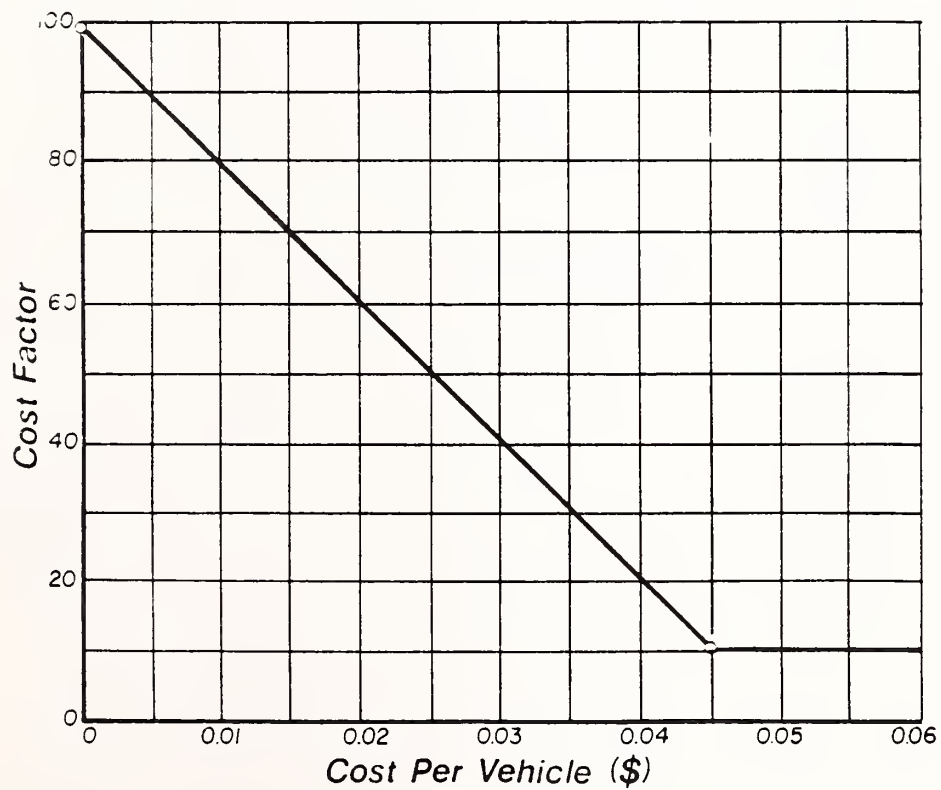
**INDICATOR VALUES FOR
DRIVER EXPECTANCY**

Figure 8



**INDICATOR VALUES FOR INFORMATION
SYSTEM DEFICIENCIES**

Figure 9



**FORM FOR DETERMINATION
OF COST FACTOR**

Figure 10

TABLE 1
RELATIVE SEVERITY INDEX

<u>TYPE OF ACCIDENT</u>	<u>Urban</u>	<u>RSI</u> <u>Rural</u>
<u>Multi-Vehicle, At Intersection</u>		
Enter at angle	\$ 4,300	\$14,400
From same direction - both going straight	2,800	5,100
From same direction - one turn, one straight	2,500	5,100
From same direction - one stopped	3,800	5,200
From same direction - all others	2,000	6,300
From opposite direction - both going straight	4,400	20,000
From opposite direction - one left turn, one straight	4,400	15,400
From opposite directions - all others	2,700	3,800
Not stated	3,800	5,200
<u>Multi-Vehicle, Non-Intersection</u>		
Going opposite direction - both moving	\$ 4,400	\$19,600
Going same direction - both moving	2,900	8,100
One car parked	1,600	2,400
One car stopped in traffic	4,200	6,800
One car entering parked position	1,900	2,300
One car leaving parked position	1,200	2,700
One car entering alley or driveway	3,400	6,000
One car leaving alley or driveway	2,000	4,400
All others	1,700	7,600
Not stated	3,400	6,000
<u>Motor Vehicle with Pedestrian, At Intersection and Non-Intersection</u>		
Vehicle going straight	\$20,000	\$49,000
Vehicle turning right	13,600	11,200
Vehicle turning left	17,100	11,200
Vehicle backing	20,600	11,200
All others	14,500	11,200
Not stated	11,200	11,200

TABLE 1

RELATIVE SEVERITY INDEX (Continued)

<u>TYPE OF ACCIDENT</u>	<u>Urban</u>	<u>RSI</u> <u>Rural</u>
<u>Single Vehicle, at Intersection</u>		
Collision with train	\$26,700	\$39,100
Collision with bicycle	13,100	31,900
Injury in vehicle, jackknifed	5,200	2,000
Collision with fixed object in road	5,500	7,000
Overtaken in road	9,200	7,500
Left road	5,200	12,300
<u>Single Vehicle, Non-Intersection</u>		
Collision with train	\$26,700	\$39,100
Collision with bicycle	13,100	31,900
Injury in vehicle, jackknifed	5,200	2,000
Collision with fixed object in road	6,300	9,200
Overtaken in road	10,000	9,400
Left road at curve	7,600	12,400
Left road on straight road	5,200	10,500
<u>Other One Motor Vehicle, At Intersection and Non-Intersection</u>		
Fell from moving vehicle	\$15,000	\$57,200
Collision with animal	4,800	1,800
Collision with other object	4,700	4,400
All others	5,200	2,000
Not stated	3,200	3,400

Source: National Safety Council

CHAPTER III

SUMMARY OF RECOMMENDATIONS

A. IMPROVEMENT PRIORITIES

Table 3 shows the final listing of improvement priorities based on the priority index which takes into account the hazardousness of each site and the cost of recommended improvements. The hazard index is given a 75 percent weight and the cost factor a 25 percent weight.

The Benefit/Cost Ratio calculated using the Montana Department of Highways' method is also shown for each site.

B. IMPLEMENTATION

The priority list should be used to develop an improvement schedule. The highest ranked site should be funded first and as funding becomes available, each site should be improved according to its respective rank.

TABLE 3

IMPROVEMENT PRIORITY LIST

Priority	Site No.	Location	Priority Index	Hazard Index	Cost	Cost/Benefit
1	20-81	Big Mtn. Rd. - Upper Switchbk.	82.86	77.81	\$ 1,280	10.70
2	6	2nd St. E. & BNRR Tracks	76.54	69.38	700	10.62
3	7	Echo Lake & Jewel Basin Rds.	74.85	62.08	460	20.38
4	21-81	East Lake Shore Drive at Hell Roaring Creek	74.66	71.55	2,680	3.73
5	13	Foothill Rd. - Curve	73.63	66.84	660	7.36
6	12	West Valley Dr. - Curve	71.93	64.24	520	13.37
7	9	Foothill Rd. - Curve	71.78	62.71	240	28.97
8	5	Whitefish Stage Rd. - Curve	71.77	63.03	540	17.07
9	15-81	Columbia Falls Stage Road at Red Bridge	71.05	62.06	960	3.76
10	4	Intersection of Columbia Falls Stage Rd. and Kelly Rd.	70.89	61.52	380	11.16
11	2	East Edgewood Dr.	70.44	63.92	1,040	4.97
12	1	McManamy Draw Rd. and Dern Draw Rd.	70.05	61.73	520	9.63
13	11	Columbia Falls Stage Rd. - Curves	69.99	60.32	240	4.97

TABLE 3

IMPROVEMENT PRIORITY LIST
(cont.)

Priority	Site No.	Location	Priority Index	Hazard Index	Cost	Cost/Benefit
14	8	Echo Lake Rd. - Curve and Hill	69.56	62.08	\$ 460	5.62
15	14	Hilltop Rd. - Curve	69.28	59.38	480	10.10
16	3	Intersection of Talbot Rd. and 12th Avenue	68.51	58.35	660	17.64
17	15	McCaffery Rd. - Curves	68.45	64.27	820	9.43
18	10	Talbot Rd. and 4th Avenue	57.85	44.13	<u>420</u>	11.16
TOTAL COST:					\$13,060	

TABLE 4
LIST OF MATERIALS

Item	Sign No.	Quantity
Stop Sign	R1-1	1
Speed Limit	R2-1	1
No Parking	R8-3	4
Turn Right	W1-1R	4
Turn Left	W1-1L	5
Curve Right	W1-2R	2
Curve Left	W1-2L	2
Reverse Curve Right	W1-4R	1
Reverse Curve Left	W1-4L	1
Winding Road	W1-5	6
Large Arrow	W1-6	22
Large Double Arrow	W1-7	2
Chevron Alignment	W1-8	24
Side Road	W2-2	1
T Symbol	W2-4	1
Stop Ahead	W3-1a	2
One Lane Bridge	W5-3	1
Loose Gravel	W8-7	1
Railroad Crossing	W10-1	1
Advisory Speed Plate	W13-1	13
Limited Sight Distance	W14-4	2
Six-Foot Flexible Delineator	--	62

If funds are not available to complete all improvements, traffic control device installation should be funded first. These are generally the most cost-effective improvements and can be accomplished by the county maintenance crew. Widening, reconstruction or new construction improvements should be made as funding is available.

State law requires that all traffic control devices installed on the county road system conform to the standards set forth in the Manual on Uniform Traffic Control Devices for Streets and Highways (1978). The manual also specifies installation standards. By using uniform signs and markings and uniform placement, the driver becomes accustomed to obtaining clear information about the roadway by observing these devices.

An exchange of road construction and maintenance methods by counties throughout the state is a valuable source of information that may result in cost savings and statewide uniformity.

C. ONGOING PROGRAM

The Kalispell City-County Master Plan shows that from 1970 to 1980, Flathead County was one of the fastest growing counties in Montana, more than doubling the state's growth rate. During that period of time, the county had a growth rate of 32 percent while the

municipalities of Kalispell, Whitefish, and Columbia Falls had growth rates of 1, 10, and 17 percent, respectively. This rapid growth in rural areas has caused an increase in traffic volumes on many of the county roads.

An ongoing safety improvement program should be maintained in order to pinpoint high accident locations and to make improvements to increase safety on the county road system.

The following is a summary of the ongoing safety improvement process:

1. Set up safety improvement schedule to implement recommended improvements set forth in this report, in order of priority and as funds become available.
2. Obtain annual plots of accidents occurring on county roads from the Montana Department of Justice, Highway Traffic Safety Division.
3. Use annual accident plots to evaluate effectiveness of safety improvements that have been implemented.
4. Use annual accident plots to determine high accident locations to be included in the ongoing safety improvement program.

5. Obtain detailed accident reports for the selected sites from the Department of Justice.
6. Develop ongoing improvement plan.

CHAPTER IV

SITE ANALYSIS

This chapter presents, in detail, the analysis of each of the sites.

The information for each site consists of the following:

1. General location map showing site locations within the county;
2. Photos of the sites;
3. Sketch plan showing existing conditions;
4. Sketch plan showing recommended improvements;
5. Accident summary; and
6. Hazard index and priority index calculations.

SITE NO.1

.....



Site 1 South Approach



Site 1 East Approach



Site 1 West Approach

SITE NO. 1

INTERSECTION OF MCMANAMY DRAW AND DERN DRAW ROADS

A. DESCRIPTION

This site is located 2.5 miles east of FAS 424, the Farm to Market Road. McManamy Draw Road is an extension of West Reserve Drive. Dern Draw Road forms a T intersection with McManamy Draw Road. Both roads are gravel surfaced; however, McManamy Road has been recently oiled approximately 1/2 mile west of the site. There is no traffic control at the intersection. There is a county road name sign located on the north side of the intersection. Low density residential development lies to the south and west of the site.

The estimated 1988 average daily traffic volumes at the intersection are 105 vpd on the east leg, 35 vpd on the south leg, and 85 vpd on the west leg.

The intersection is uncontrolled.

The existing site characteristics are shown on Figure 1-1.

B. ACCIDENT ANALYSIS

Five accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

- * Three accidents occurred during hours of darkness or dusk.
- * Road conditions were dry when three of the accidents occurred and wet or icy when the other two occurred.
- * Four of the accidents involved single vehicles leaving the road.
- * The investigating officers' analysis attributed the accidents to the following factors: rutted road, vision obscured by curve, loose gravel, speed too fast for conditions, careless driving, and alcohol.
- * One of the accidents involved alcohol.

Accident diagrams are shown in Figure 1-1. Table 1-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. Eighty percent of the accidents involved single vehicles leaving the roadway
2. Sight is obstructed on all approaches; however, this was not a major contributor to accidents.
3. The road has an oiled surface to the west of the site. The surface through the site is loose gravel over a corrugated base. Vehicles may be entering the gravel surfaced area at speeds too high for the conditions, causing the driver to lose control. The downgrade from the west into the site contributes to the surface corrugation.

D. RECOMMENDATIONS

The following improvements are recommended for this site.

1. Improve sight triangle at intersection by trimming brush and trees in the southwest and southeast quadrants.

2. Widen shoulders and periodically grade to remove washboarding.
3. Install a LOOSE GRAVEL (W8-7) sign 250 feet west of the end of pavement west of the site. This location does not show on the plan and will have to be located in the field.
4. Install curve signs on the east and west approaches. The recommended improvements are shown on Figure 1-2.

Long-Range Improvements

As residential growth occurs, the road through the site should be paved by extending pavement from the west of the site.

E. COST

1. Improve sight triangle	\$100.00
2. Widen shoulders, grade	(normal maintenance)
3. Install LOOSE GRAVEL sign (W8-7)	140.00
4. Install CURVE signs (W1-2R & W1-2L)	<u>280.00</u>
TOTAL COST	\$520.00

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 61.73. The priority index is 70.05. The calculations are shown in Table 1-2.

ACCIDENT SUMMARY

SITE NUMBER 1 ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
3	1		1

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
	1	1			2	1

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
					2		1		1		1

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
					1	1					1			1								1	

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day-light	Dark	Dawn	Dusk
2	2	1	

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
3	1		1	

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
3	2		

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side-swipe	Non-Col	Head-on	Backing
			4					1	

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right-of-Way	Improper Passing	Improper Backing	Improper Turning	Other
3	1							1

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
1	1		
2			1

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

1

TABLE 1-2
HAZARD INDEX CALCULATION

Site Number 1 Date _____

Site Description Intersection of McManamy Draw and Dern Draw

Roads _____

Indicator	Data Value		Indicator Value		Weight		Partial H.I.s
No. of Accidents	<u>1.25</u>	acc/yr	<u>25</u>	X	0.164	=	<u>4.10</u>
Accident Rate	<u>30.4</u>	acc/MVE	<u>100</u>	X	0.225	=	<u>22.50</u>
Accident Severity	<u>9620</u>	dollars	<u>60</u>	X	0.191	=	<u>11.46</u>
Volume/Capacity Ratio	<u>0.04</u>		<u>15</u>	X	0.082	=	<u>1.23</u>
Sight Distance Ratio	<u>0.50</u>	(wt.avg.)	<u>100</u>	X	0.074	=	<u>7.40</u>
Driver Expectancy	<u>3.0</u>	(wt.avg.)	<u>50</u>	X	0.149	=	<u>7.45</u>
Information System Deficiencies	<u>4.0</u>	(wt.avg.)	<u>66</u>	X	0.115	=	<u>7.59</u>

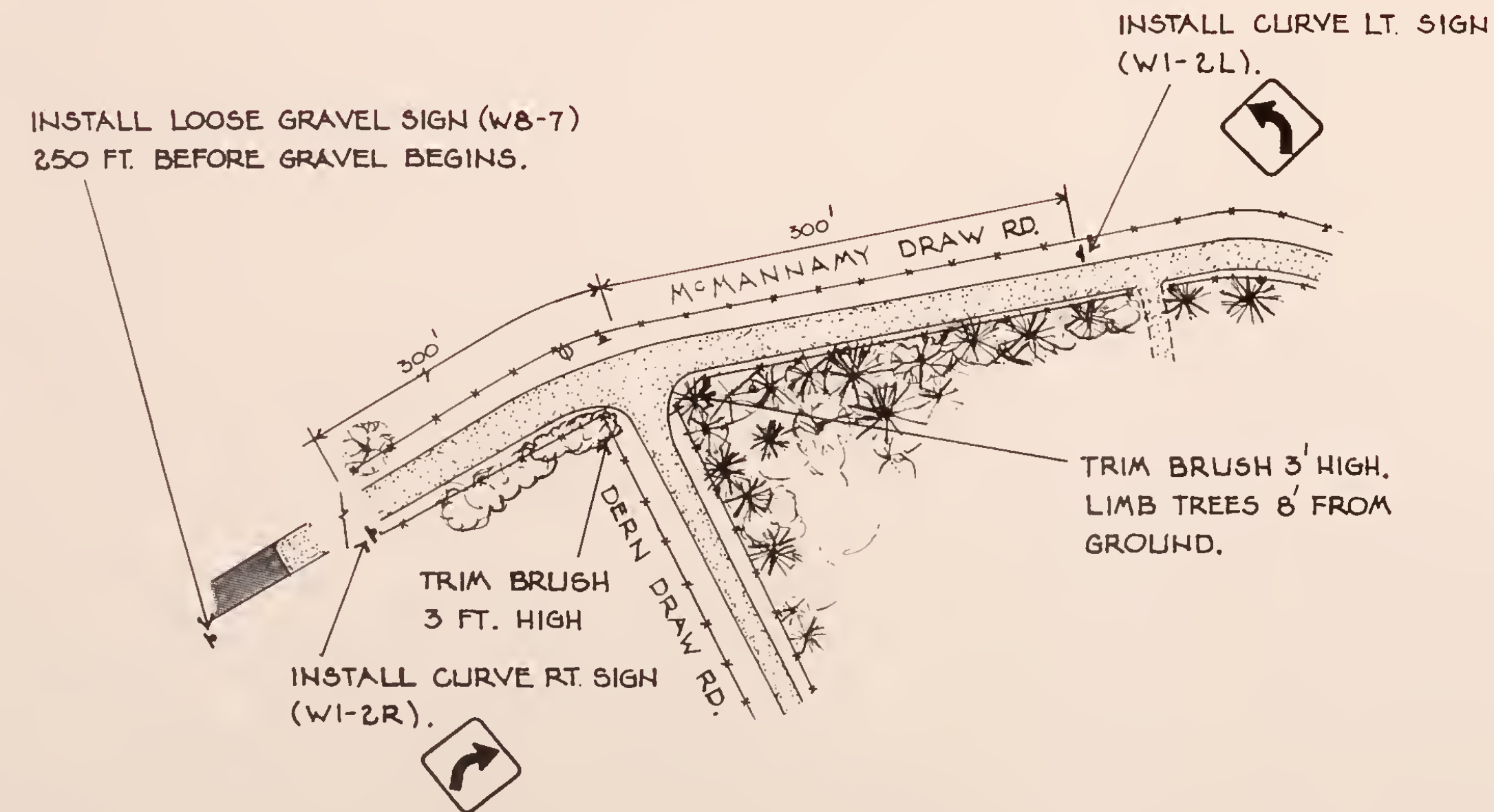
Hazard Index: 61.73

Cost of Recommended Improvements: \$520.00

Cost Factor: 95

Priority Index = Hazard Index x .75 + Cost Factor x .25

$$\underline{61.73} \times .75 + \underline{95} \times .25 = \underline{70.05}$$



SITE NO. 1 **FLATHEAD COUNTY, MT.**

Recommended Improvements

McMannamy Draw & Dern Draw Roads

Fig. No.

1-2

SITE NO.2

.....



Site 2 East Approach - South
Curve



Site 2 West Approach - North
Curve



Site 2 Mid Curve - North Curve



Site 2 East Approach - South
Curve

SITE NO. 2

EAST EDGEWOOD DRIVE - CURVE

A. DESCRIPTION

This site is a 90 degree curve on East Edgewood Drive, approximately 3.1 miles east of Whitefish. The site is located in Section 34, Township 31 North, Range 21 West.

The road serves low density, rural farmsteads. At the curve, the roadway has a gravel surface; south of the curve, along the frontage of a horse ranch, the road has been oiled for dust control.

The width of the roadway varies from 22 to 24 feet. A private access road to the north is located at the curve. Approach site distance is restricted by brush and trees. The estimated average daily traffic through the site is 120 vpd.

The existing site characteristics are shown on Figure 2-1.

B. ACCIDENT ANALYSIS

Six accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

- * Four accidents occurred during hours of darkness.
- * Road condition was dry when four of the accidents occurred and icy when two of the accidents occurred.
- * Five of the accidents involved single vehicles leaving the road.
- * Two of the accidents resulted in injuries.
- * The investigating officers' analysis attributed the accidents to the following factors: careless driving, alcohol, and failure to drive on right of roadway.
- * Alcohol was involved in two of the accidents.

Accident diagrams are shown on Figure 2-1. Table 2-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. Eighty-three percent of the accidents involved single vehicles leaving the roadway. The major contributor appears to be speed too fast for conditions.
2. Sixty-seven percent of the accidents occurred during hours of darkness, suggesting that driver perception of the roadway may not be adequate during these hours.
3. There are several clumps of trees growing within the right-of-way. Some of these limit sight distance on the north curve.
4. The curve was ball banked at 15 MPH.

D. RECOMMENDATIONS

The following improvements are recommended for this site.

1. Improve sight triangle on north curve by removing two clumps of fir and pine trees from the right-of-way.

2. Install a RIGHT TURN sign (W1-1R) with a 15 MPH advisory speed plate (W13-1) on the west approach to the site.
3. Install a LEFT TURN sign (W1-1L) with a 15 MPH advisory speed plate (W13-1) on the east approach to the site.
4. Install two large arrow signs (W1-6) in the northeast quadrant of the north curve. It appears that these signs can be mounted on one post; however, final determination should be made at time of installation.
5. Install a large arrow sign (W1-6) facing the east approach of the south curve.
6. Install a large arrow sign (W1-6) facing the north approach of the south curve.

The recommended improvements are shown in Figure 2-2.

E. COST

1. Improve sight triangle; remove fir
and pine trees \$200.00

2.	Install right and left curve signs (W1-1R and W1-1L) with 15 mph advisory speed plates (W13-1)	280.00
3.	Install four large arrow signs (W1-6)	<u>560.00</u>
	TOTAL COST	\$1,040.00

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 63.92. The priority index is 70.44. The calculations are shown in Table 2-2.

ACCIDENT SUMMARY

SITE NUMBER 2 ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
	1	3	2

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
1	1	2				2

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	2				1		2	1			

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1							1	1						1		1						1	

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day- Night	Dark	Dawn	Dusk
4	2		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
4			2	

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
4	1		

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side- swipe	Non-Col	Head- on	Backing
1			3				1	1	

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right- of-Way	Improper Passing	Improper Backing	Improper Turning	Other
	1		1	1				1

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
	1	2	1

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

2

TABLE 2-2
HAZARD INDEX CALCULATION

Site Number 2 Date _____

Site Description East Edgewood Drive - Curve

Indicator	Data Value		Indicator Value		Weight		Partial H.I.s
No. of Accidents	<u>1.5</u>	acc/yr	<u>24</u>	X	0.164	=	<u>3.94</u>
Accident Rate	<u>34.2</u>	acc/MVE	<u>100</u>	X	0.225	=	<u>22.50</u>
Accident Severity	<u>12,983</u>	dollars	<u>71</u>	X	0.191	=	<u>13.56</u>
Volume/Capacity Ratio	<u>0.05</u>		<u>18</u>	X	0.082	=	<u>1.48</u>
Sight Distance Ratio	<u>0.50</u>	(wt.avg.)	<u>100</u>	X	0.074	=	<u>7.40</u>
Driver Expectancy	<u>3.0</u>	(wt.avg.)	<u>50</u>	X	0.149	=	<u>7.45</u>
Information System Deficiencies	<u>4.0</u>	(wt.avg.)	<u>66</u>	X	0.115	=	<u>7.59</u>

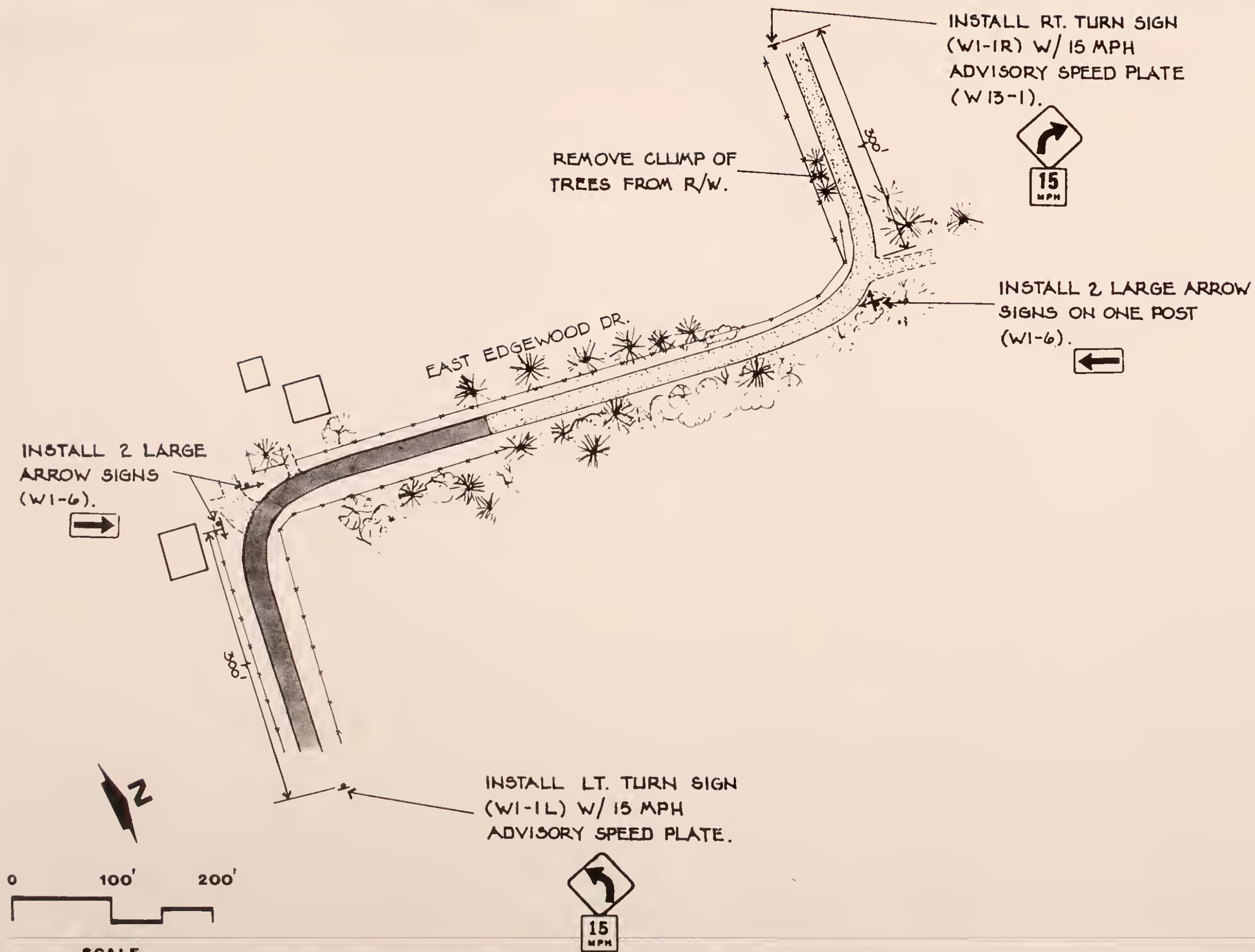
Hazard Index: 63.92

Cost of Recommended Improvements: \$1040.00

Cost Factor: 90

Priority Index = Hazard Index x .75 + Cost Factor x .25

$$\underline{63.92} \times .75 + \underline{90} \times .25 = \underline{70.44}$$



SITE NO. 2
FLATHEAD COUNTY, MT.

Recommended Improvements

East Edgewood Drive

Fig. No.

2-2

SITE NO.3
.....



Site 3 West Approach



Site 3 Looking North



Site 3 East Approach



Site 3 North Approach



Site 3 North Approach



Site 3 East Approach

SITE NO. 3

INTERSECTION OF 12TH AVE. WEST AND TALBOT ROAD

A. DESCRIPTION

This site is a T intersection located at the south city limits of Columbia Falls. The site is located in Section 17, Township 30 North, Range 20 West.

An elementary school is located one and one-half blocks north of the site. Talbot Road serves low density, rural farmsteads to the west and low density suburban development to the east. Twelfth Avenue West is an arterial street extending from Talbot Road to Tamarack Lane on the north side of Columbia Falls. Both streets have a paved surface approximately 24 feet wide.

Talbot Road has a 3.7 percent grade east of the intersection and Twelfth Avenue West a 9.2 percent grade at the intersection.

The estimated 1988 average daily traffic is 195 vpd on the north leg and 410 vpd on the east and west legs.

The existing site characteristics are shown on Figure 3-1.

B. ACCIDENT ANALYSIS

- * Seven accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:
- * Four accidents occurred during hours of darkness.
- * Road condition was dry when five of the accidents occurred and icy when the other two accidents occurred.
- * Three of the accidents involved southbound vehicles failing to stop and going over the steep bank on the south side of Talbot Road.
- * Five of the accidents resulted in injuries.
- * Three of the accidents involved eastbound vehicles turning left from Talbot Road onto Twelfth Avenue West and colliding with westbound vehicles on Talbot Road.
- * Four of the accidents involved single vehicles leaving the roadway.

- * The investigating officers' analysis attributed the accidents to the following factors: faulty brakes, vision obscured by hill or curve, improper turn, alcohol, and speed too fast for conditions.
- * Alcohol was involved in two of the accidents.

Accident diagrams are shown on Figure 3-1. Table 3-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. The limited sight distance for eastbound vehicles turning left from Talbot Road onto Twelfth Avenue West was the probable cause of three of the accidents.
2. Three of the accidents (43 percent) were the result of single vehicles failing to stop on the north approach and proceeding across Talbot Road over the steep bank on the south side of the road. The roadway is narrow (22 feet) at this point with no shoulder.

D. RECOMMENDATIONS

The following improvements are recommended for this site.

1. Trim grass in intersection median and trim tree limbs in southeast quadrant of the intersection.
2. Install a large double arrow sign (W1-7) on the south side of the intersection. Due to the steep bank with no shoulder, it will be necessary to use a long post set into the bank.
3. Remove 35 MPH advisory speed plates (W13-1) from the existing side road left and side road right signs on the west and east approaches. Replace 45° side road right sign on the east approach with a 90° side road right sign (W2-2).
4. Install a limited sight distance sign (W14-4) with a 30 MPH advisory speed plate (W13-1) on the east and west approaches to the site. These signs should be approximately 50 feet in front of the side road signs.

The recommended improvements are shown in Figure 3-2.

Long-Range Improvements

Long-range improvements would involve the reconstruction of the intersection. The following changes would be required:

- * Relocate the right turn lane from the north approach to the east. This would move the turning movements to the crest of the hill, giving approaching vehicles from the east adequate sight distance. An alternative would be to shave the crest of the hill.
- * Widen Talbot Road on the north side, through the intersection, increasing the south shoulder width.
- * Install guard rail along the south side of the intersection.

E. COST

1. Trim grass and trees	\$100.00
2. Replace side road right 45° with side road right 90° (W2-2)	140.00
3. Install double arrow sign (W1-7)	140.00
4. Install two limited sight distance signs (W14-4)	<u>280.00</u>
TOTAL COST	\$660.00

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 58.35. The priority index is 68.51. The calculations are shown in Table 3-2.

ACCIDENT SUMMARY

SITE NUMBER 3 ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
1	2	1	3

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
	2			2	1	2

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2						2	1		1		1

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
		1	1				1					1								2			1

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day-light	Dark	Dawn	Dusk
3	4		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
5		1	1	

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
5	1	1	

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side-swipe	Non-Col	Head-on	Backing
		1	2				2	2	

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right-of-Way	Improper Passing	Improper Backing	Improper Turning	Other
	1		1				2	3

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
1	1	1	2
	1		1

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

2

TABLE 3-2
HAZARD INDEX CALCULATION

Site Number 3 Date _____

Site Description Intersection of Talbot Road and 12th Avenue

Indicator	Data Value		Indicator Value	Weight	Partial H.I.s
No. of Accidents	<u>1.75</u>	acc/yr	<u>26</u>	X 0.164	= <u>4.26</u>
Accident Rate	<u>7.92</u>	acc/MVE	<u>88</u>	X 0.225	= <u>19.80</u>
Accident Severity	<u>4771</u>	dollars	<u>45</u>	X 0.191	= <u>8.60</u>
Volume/Capacity Ratio	<u>0.16</u>		<u>33</u>	X 0.082	= <u>2.71</u>
Sight Distance Ratio	<u><.50</u>	(wt.avg.)	<u>100</u>	X 0.074	= <u>7.40</u>
Driver Expectancy	<u>4.0</u>	(wt.avg.)	<u>66</u>	X 0.149	= <u>9.83</u>
Information System Deficiencies	<u>3.0</u>	(wt.avg.)	<u>50</u>	X 0.115	= <u>5.75</u>

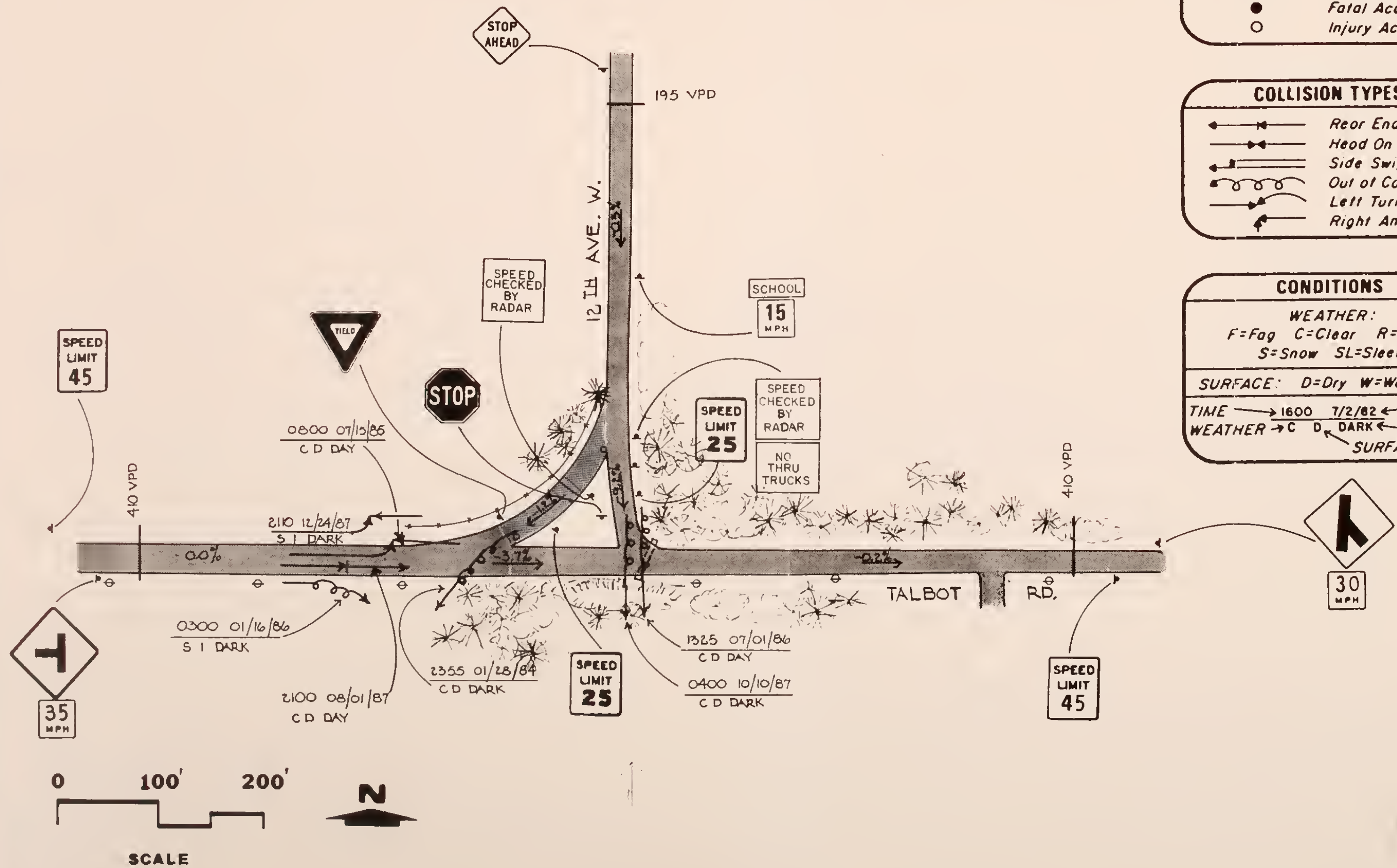
Hazard Index: 58.35

Cost of Recommended Improvements: \$660.00

Cost Factor: 99

Priority Index = Hazard Index x .75 + Cost Factor x .25

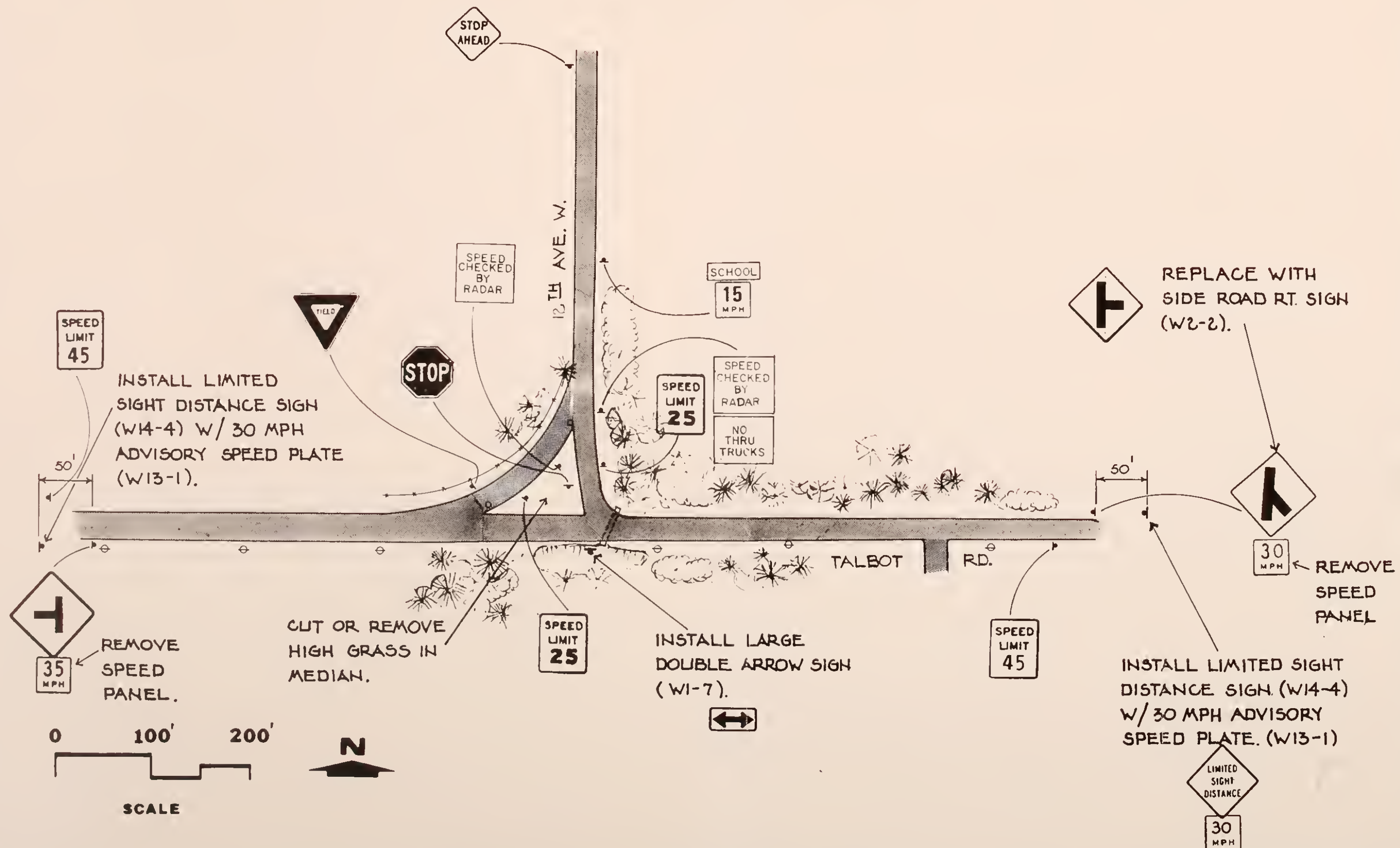
$$\underline{58.35} \times .75 + \underline{99} \times .25 = \underline{68.51}$$



SYMBOLS	
	Moving Vehicle
	Backing Vehicle
	Pedestrian Path
	Parked Vehicle
	Fixed Object
	Fatal Accident
	Injury Accident

COLLISION TYPES	
	Rear End
	Head On
	Side Swipe
	Out of Control
	Left Turn
	Right Angle

CONDITIONS	
WEATHER:	
F=Fog	C=Clear
R=Rain	S=Snow
SL=Steel	
SURFACE:	
D=Dry	W=Wet
I=icy	
TIME → 1600	7/2/82 ← DATE
WEATHER → C	D ← DARK
	← LIGHT
	SURFACE



SITE NO.4

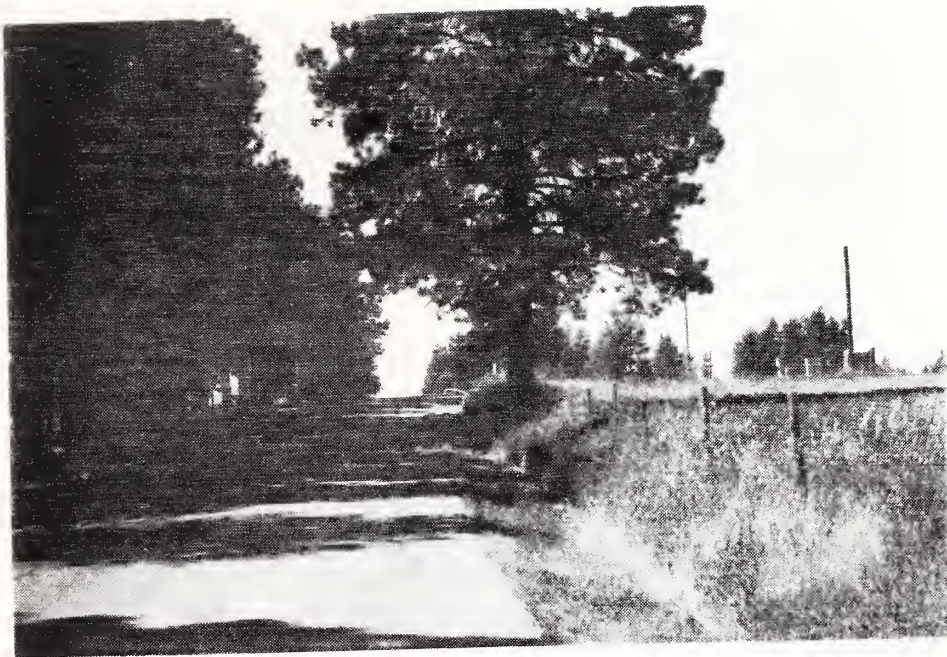
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Site 4 West Approach



Site 4 West Approach



Site 4 East Approach



Site 4 North Approach

SITE NO. 4

INTERSECTION OF COLUMBIA FALLS STAGE AND KELLY ROADS

A. DESCRIPTION

This site is located approximately 2.0 miles south of Columbia Falls at the intersection of Columbia Falls Stage Road and Kelly Road. Kelly Road forms a T intersection with Columbia Falls Stage Road. Both roads have a paved surface. The site is located in Section 20, Township 30 North, Range 20 West. There is a STOP sign on the north leg of the intersection (Columbia Falls Stage Road). There are side road left and right signs on the east and west approaches of Kelly Road. There is a large double arrow sign on the south side of the intersection.

The estimated 1988 average daily traffic is as follows:

North leg - 320 vpd

East leg - 150 vpd

West leg - 155 vpd

The existing site characteristics are shown on Figure 4-1.

B. ACCIDENT ANALYSIS

Five accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

- * All five accidents occurred on weekends.
- * All five accidents occurred during hours of darkness.
- * Road conditions were dry when the accidents occurred.
- * The weather was clear when four accidents occurred and foggy when one accident occurred.
- * Four of the accidents involved single vehicles leaving the road.
- * Four of the vehicles collided with objects off the roadway including a tree, sign, utility pole, and fence.
- * The investigating officers' analysis attributed the accidents to the following factors: careless driving, vision obscured by hill or curve, failure to yield right-of-way, speed too fast for conditions, and faulty brakes.

* Alcohol was involved in four of the accidents.

Accident diagrams are shown on Figure 4-1. Table 4-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. Three (60 percent) of the accidents involved southbound vehicles going off the road on the south side of the intersection.
2. The other two accidents (40 percent) involved eastbound vehicles turning left onto Columbia Falls Stage Road.
3. Bushes and tree limbs obscure the side road signs on the east and west approaches of the intersection.

D. RECOMMENDATIONS

The following improvements are recommended for this site.

1. Trim brush and tree limbs from the side road left and side road right signs (W2-2) on the east and west approaches of the site.
2. Install a STOP AHEAD sign (W14-4) with a 35 MPH advisory speed plate (W13-1) on the west approach to the site.

The recommended improvements are shown in Figure 4-2.

E. COST

1. Trim bushes and tree	\$100.00
2. Install STOP AHEAD sign (W3-1a)	140.00
3. Install limited sight distance sign (W14-4) with a 35 MPH advisory speed plate (W13-1)	<u>140.00</u>
 TOTAL COST	 \$380.00

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 61.52. The priority index is 70.89. The calculations are shown in Table 4-2.

ACCIDENT SUMMARY

SITE NUMBER 4

ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
1		1	3

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
1						4

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1			1					2	1		

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2			1																	1	1		

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day-Light	Dark	Dawn	Dusk
	5		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
5				

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
4			1

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side-swipe	Non-Col	Head-on	Backing
	1		4						

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right-of-Way	Improper Passing	Improper Backing	Improper Turning	Other
			1	1				3

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
1		1	2
			1

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

4

TABLE 4-2
HAZARD INDEX CALCULATION

Site Number 4 Date _____

Site Description Intersection of Columbia Falls Stage and Kelly Roads

Indicator	Data Value		Indicator Value		Weight		Partial H.I.s
No. of Accidents	<u>1.25</u>	acc/yr	<u>25</u>	X	0.164	=	<u>4.10</u>
Accident Rate	<u>10.96</u>	acc/MVE	<u>100</u>	X	0.225	=	<u>22.50</u>
Accident Severity	<u>12,720</u>	dollars	<u>71</u>	X	0.191	=	<u>13.56</u>
Volume/Capacity Ratio	<u>0.13</u>		<u>30</u>	X	0.082	=	<u>2.46</u>
Sight Distance Ratio	<u>0.66</u>	(wt.avg.)	<u>77</u>	X	0.074	=	<u>5.70</u>
Driver Expectancy	<u>3.0</u>	(wt.avg.)	<u>50</u>	X	0.149	=	<u>7.45</u>
Information System Deficiencies	<u>3.0</u>	(wt.avg.)	<u>50</u>	X	0.115	=	<u>5.75</u>

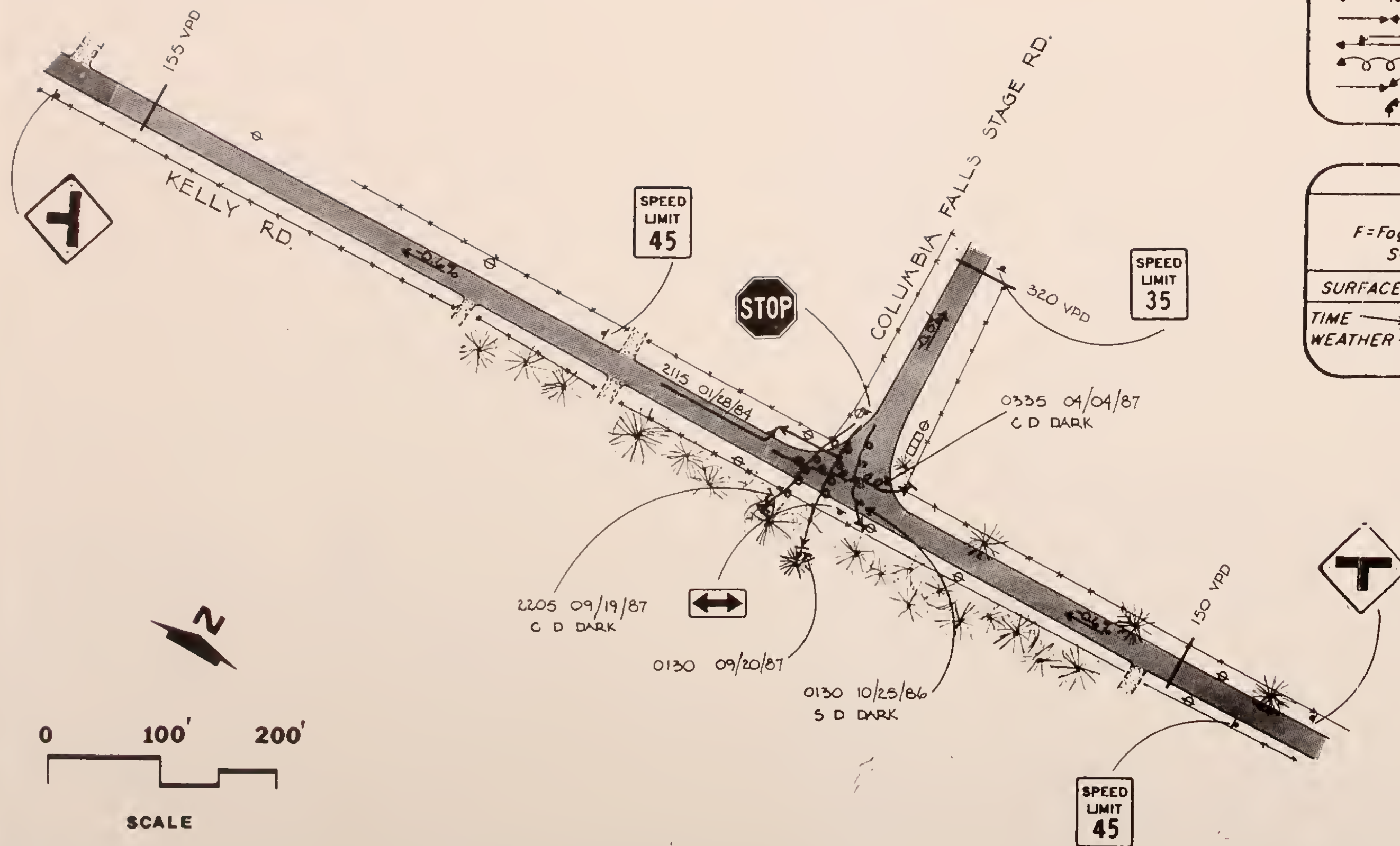
Hazard Index: 61.52

Cost of Recommended Improvements: \$380.00

Cost Factor: 99

Priority Index = Hazard Index x .75 + Cost Factor x .25

$$\underline{61.52} \times .75 + \underline{99} \times .25 = \underline{70.89}$$



SYMBOLS

	Moving Vehicle
	Backing Vehicle
	Pedestrian Path
	Parked Vehicle
	Fixed Object
	Fatal Accident
	Injury Accident

COLLISION TYPES

	Rear End
	Head On
	Side Swipe
	Out of Control
	Left Turn
	Right Angle

CONDITIONS

WEATHER:

F=Fog C=Clear R=Rain
S=Snow SL=Sleet

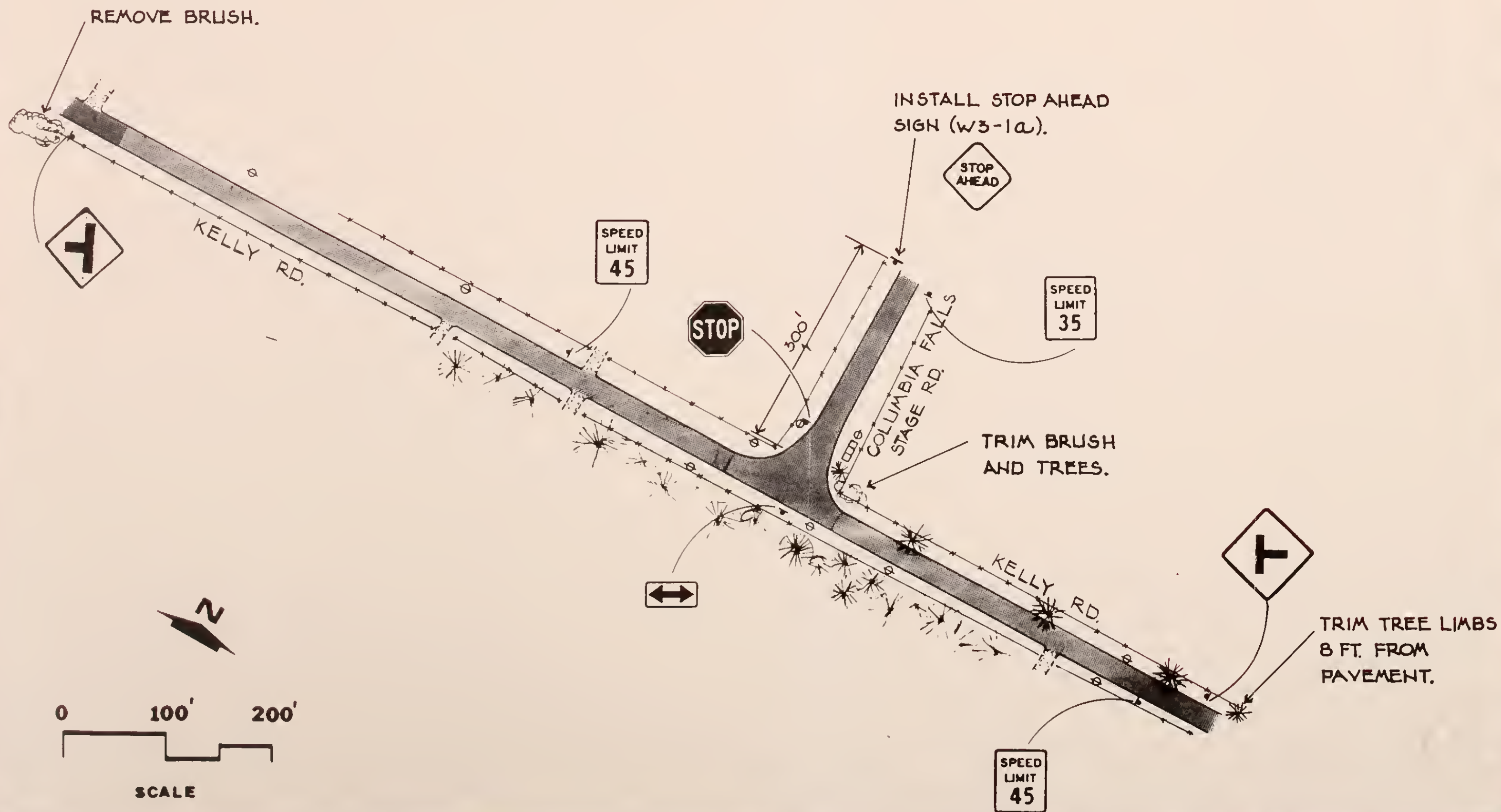
SURFACE: D=Dry W=Wet I=Icy

TIME → 1600 7/2/82 ← DATE
WEATHER → C D ← DARK ← LIGHT
 ← SURFACE

SITE NO. 4
FLATHEAD COUNTY, MT.
Existing Conditions & Accidents
Columbia Falls Stage Road & Kelly Road

Fig. No.

4-1



Recommended Improvements

SITE NO. 4
FLATHEAD COUNTY, MT.

Columbia Falls Stage Road & Kelly Road

Fig. No.

4-2

SITE NO.5

.....



Site 5 North Approach



Site 5 South Approach

SITE NO. 5

WHITEFISH STAGE ROAD - CURVE

A. DESCRIPTION

This site is a double curve on Whitefish Stage Road approximately one-half mile south of its intersection with Hodgson Road. The site is located in Section 29, Range 21 West, Township 30 North. The roadway is paved with center and shoulder stripes. There is scattered residential development along the roadway at this location.

The estimated 1988 average daily traffic is 260 vpd.

The existing site characteristics are shown on Figure 5-1.

B. ACCIDENT ANALYSIS

Five accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

* Three accidents occurred during hours of darkness.

- * All accidents occurred when the road conditions were dry.
- * All the accidents involved single vehicles leaving the road.
- * Two of the accidents resulted in injuries.
- * The investigating officers' analysis attributed the accidents to the following factors: speed too fast for conditions, alcohol, and defective tire.
- * Alcohol was involved in three of the accidents.

Accident diagrams are shown on Figure 5-1. Table 5-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. The northern curve is at the end of a long tangent section and is the first curve south of the intersection of Hodgson Road. All accidents involved southbound vehicles. Excessive speed was a factor in all of the accidents.

D. RECOMMENDATIONS

The following improvements are recommended for this site.

1. Install a reverse curve left sign (W1-4L) on the north approach and a reverse curve right sign (W1-4R) on the south approach to the site.
2. Install a large arrow (W1-6) on the north curve.
3. Install six six-foot flexible delineators on the north curve.

The recommended improvements are shown in Figure 5-2.

E. COST

1. Install two reverse curve signs (W1-4L and W1-4R)	\$280.00
2. Install large arrow sign (W1-6)	140.00
3. Install six 6-ft. flexible delineators	<u>120.00</u>
TOTAL COST	\$540.00

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 68.03. The priority index is 71.77. The calculations are shown in Table 5-2.

ACCIDENT SUMMARY

SITE NUMBER 5 ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
	4		1

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
1				1	1	2

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
				1	1	2			1		

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2	1																1		1				

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day-light	Dark	Dawn	Dusk
2	3		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
5				

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
4	1		

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side-swipe	Non-Col	Head-on	Backing
			1				4		

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right-of-Way	Improper Passing	Improper Backing	Improper Turning	Other
1	1		3					

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
	4		
			1

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

3

TABLE 5-2
HAZARD INDEX CALCULATION

Site Number 5 Date _____

Site Description Whitefish Stage Road - Curve

Indicator	Data Value		Indicator Value		Weight		Partial H.I.s
No. of Accidents	<u>1.25</u>	acc/yr	<u>25</u>	X	0.164	=	<u>4.10</u>
Accident Rate	<u>13.17</u>	acc/MVE	<u>100</u>	X	0.225	=	<u>22.50</u>
Accident Severity	<u>12,500</u>	dollars	<u>70</u>	X	0.191	=	<u>13.37</u>
Volume/Capacity Ratio	<u>0.01</u>		<u>27</u>	X	0.082	=	<u>2.21</u>
Sight Distance Ratio	<u>0.66</u>	(wt.avg.)	<u>77</u>	X	0.074	=	<u>5.70</u>
Driver Expectancy	<u>3</u>	(wt.avg.)	<u>50</u>	X	0.149	=	<u>7.45</u>
Information System Deficiencies	<u>4</u>	(wt.avg.)	<u>67</u>	X	0.115	=	<u>7.70</u>

Hazard Index: 63.03

Cost of Recommended Improvements: \$540.00

Cost Factor: 98

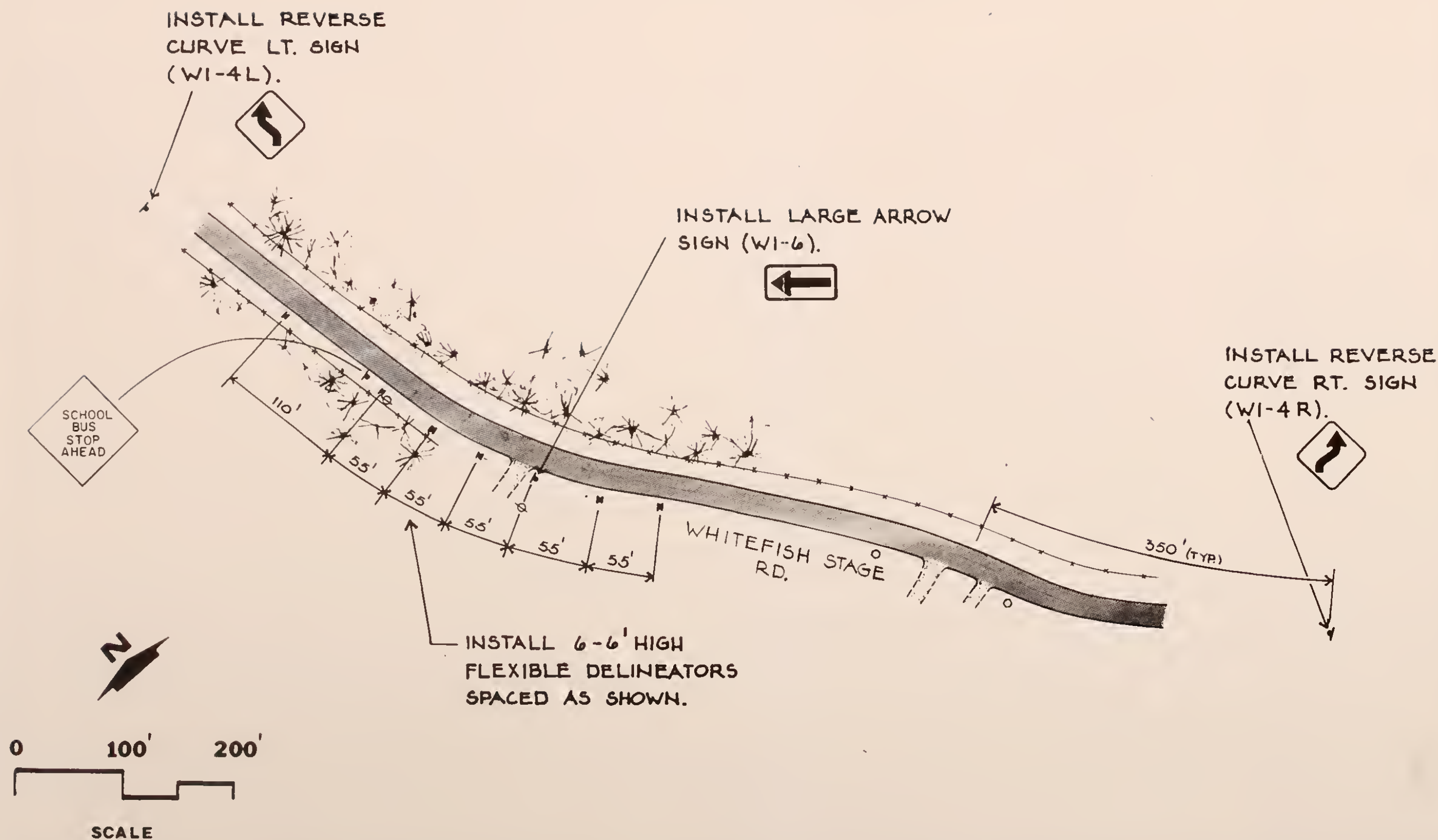
Priority Index = Hazard Index x .75 + Cost Factor x .25

$$\underline{63.03} \times .75 + \underline{98} \times .25 = \underline{71.77}$$

SITE NO. 5
FLATHEAD COUNTY, MT.

Fig. No.

5-2



SITE NO.6





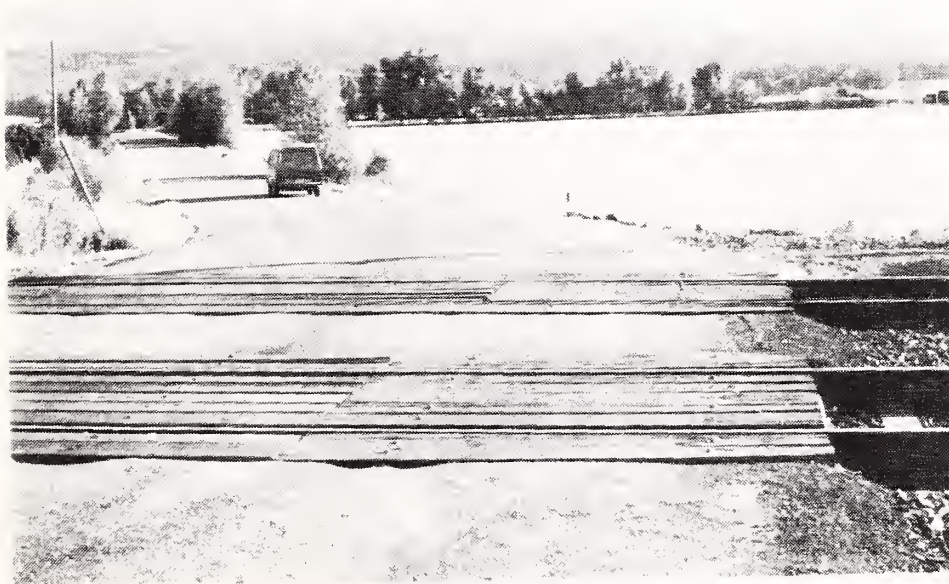
Site 6 South Approach



Site 6 North Approach



Site 6 South Approach



Site 6 at Tracks Looking
North

SITE NO. 6

EAST SECOND STREET AND BURLINGTON NORTHERN RAILROAD TRACKS - WHITEFISH

A. DESCRIPTION

This site is located approximately one mile east of the Whitefish city limits in Section 32, Range 21 West, Township 31 North. The paved roadway curves as it crosses the railroad tracks. The approaches to the crossing are elevated with steep side slopes. Approaching from the south, it is difficult for a driver to see the curve in the roadway due to the vertical curve at the tracks. The same condition exists on the north approach but it is not as extreme. The turning movement must be made as the railroad tracks are being crossed. This causes the vehicle to slip sideways on the track.

The 1988 average daily traffic at the crossing is estimated to be 210 vpd.

The existing site characteristics are shown on Figure 6-1.

B. ACCIDENT ANALYSIS

Seven accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

- * Six accidents occurred during dark or dawn hours and one during daylight hours.
- * Two accidents occurred when road conditions were dry and weather clear. Five accidents occurred when road conditions were wet, icy, or snowy and the weather condition was rain or snow.
- * Six of the accidents involved single vehicles leaving the road.
- * Three of the accidents resulted in injuries.
- * The investigating officers' analysis attributed the accidents to the following factors: speed too fast for existing conditions, reckless driving, and washboard surface.
- * Alcohol was involved in two of the accidents.

Accident diagrams are shown on Figure 6-1. Table 6-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. Seventy-one percent of the accidents involved northbound vehicles. These were single-vehicle accidents and excessive approach speed was generally considered to be the cause.
2. The crossing was ball-banked at 15 mph.

D. RECOMMENDATIONS

The following improvements are recommended for this site.

1. Replace the north railroad crossing sign (W10-1). This sign was missing when the final site inspection was made. Move location closer to crossing (see Figure 6-2).

2. Install a left turn sign (W1-1L) with a 15 MPH advisory speed plate (W13-1) on the west approach and a right turn sign (W1-1R) with a 15 MPH advisory speed plate (W13-1) on the north approach.
3. Install two large turn arrows on one post located on the south side of the tracks (see Figure 6-2). The mounting height of the large arrow for the north approach should be determined in the field so that it is clearly visible.

The recommended improvements are shown in Figure 6-2.

Long-Range Improvements

The steep slope along the south and east sides of the roadway makes recovery nearly impossible. This could be alleviated by installing a guard rail on the east side of the north and south approaches.

E. COST

- | | |
|--|----------|
| 1. Replace railroad crossing sign (W10-1) | \$140.00 |
| 2. Install left and right turn signs (W1-1L and 1R)
with 15 MPH advisory speed plates (W13-1) | 280.00 |

3. Install two large arrows (W6-1)	<u>280.00</u>
------------------------------------	---------------

TOTAL COST	\$700.00
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F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 69.38. The priority index is 76.54. The calculations are shown in Table 6-2.

ACCIDENT SUMMARY

SITE NUMBER 6

ACCIDENT PERIOD

1984-1987

NUMBER OF ACCIDENTS BY YEAR

1984	1985	1986	1987
	4	2	1

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
	2		3	1	1	

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2				2			1	1		1	

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1	1	1				1						1									1	

NUMBER OF ACCIDENTS BY LIGHT CONDITIONS

Day-Night	Dark	Dawn	Dusk
1	5	1	

NUMBER OF ACCIDENTS BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
2	1		3	1

NUMBER OF ACCIDENTS BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
2	3	2	

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side-swipe	Non-Col	Head-on	Backing
1			2				4		

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right-of-Way	Improper Passing	Improper Backing	Improper Turning	Other
1		2	3					1

NUMBER OF ACCIDENTS BY SEVERITY

Injury
Fatality
Property
Dam. Only

1984	1985	1986	1987
	2		1
	2	2	

NUMBER OF ACCIDENTS ALCOHOL INVOLVED

2

TABLE 6-2
HAZARD INDEX CALCULATION

Site Number 6 Date _____

Site Description East Second Street and Burlington Northern
Railroad Tracks - Whitefish

Indicator	Data Value		Indicator Value		Weight		Partial H.I.s
No. of Accidents	<u>1.75</u>	acc/yr	<u>38</u>	X	0.164	=	<u>6.23</u>
Accident Rate	<u>22.83</u>	acc/MVE	<u>100</u>	X	0.225	=	<u>22.50</u>
Accident Severity	<u>5,429</u>	dollars	<u>50</u>	X	0.191	=	<u>9.55</u>
Volume/Capacity Ratio	<u>0.08</u>		<u>25</u>	X	0.082	=	<u>2.05</u>
Sight Distance Ratio	<u><.50</u>	(wt.avg.)	<u>100</u>	X	0.074	=	<u>7.40</u>
Driver Expectancy	<u>5</u>	(wt.avg.)	<u>82</u>	X	0.149	=	<u>12.22</u>
Information System Deficiencies	<u>5</u>	(wt.avg.)	<u>82</u>	X	0.115	=	<u>9.43</u>

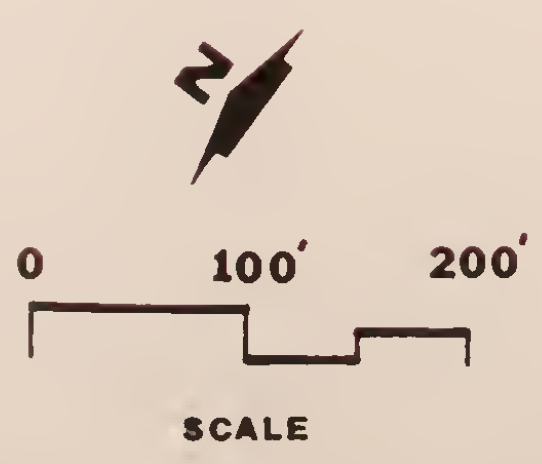
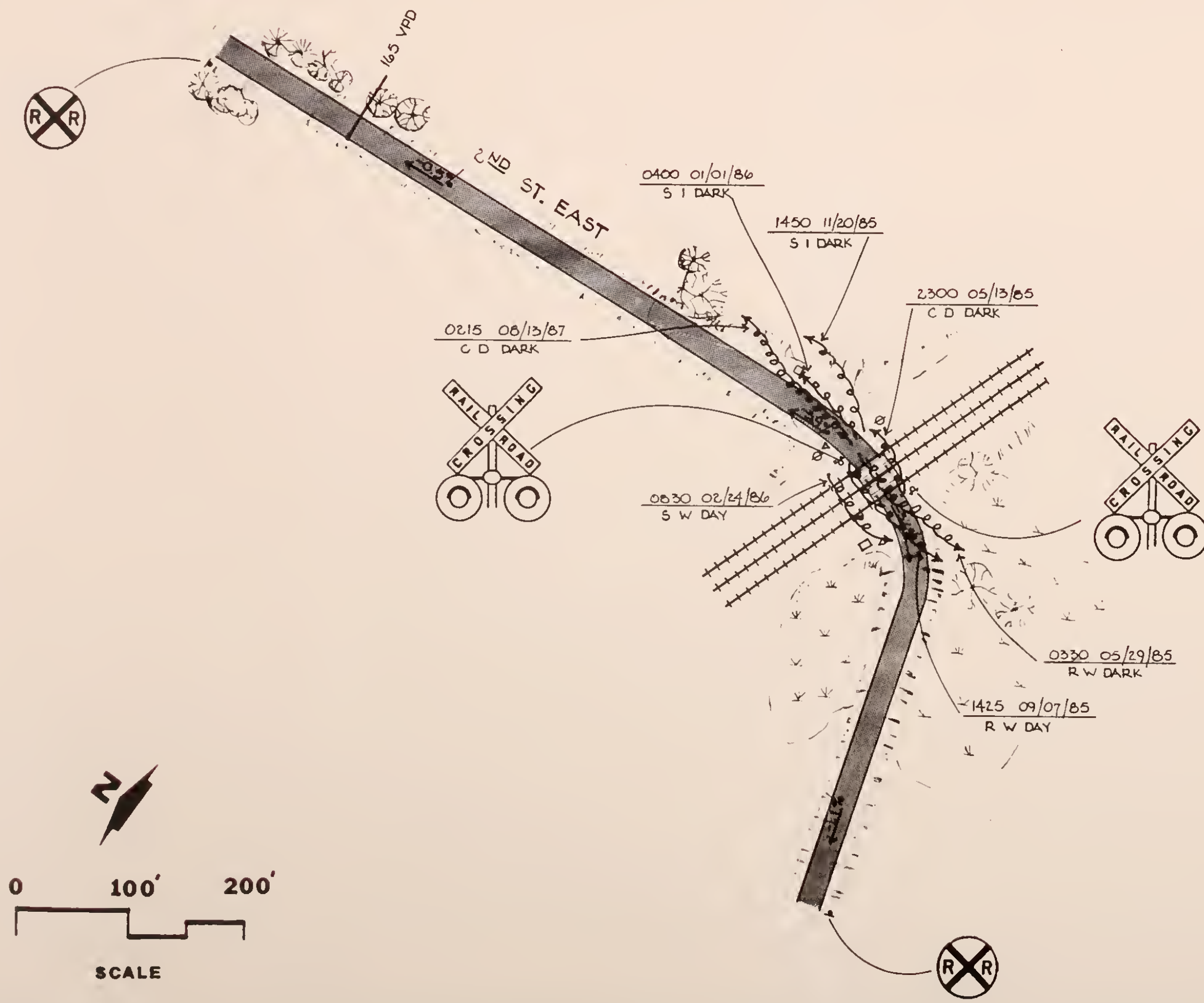
Hazard Index: 69.38

Cost of Recommended Improvements: \$700.00

Cost Factor: 98

Priority Index = Hazard Index x .75 + Cost Factor x .25

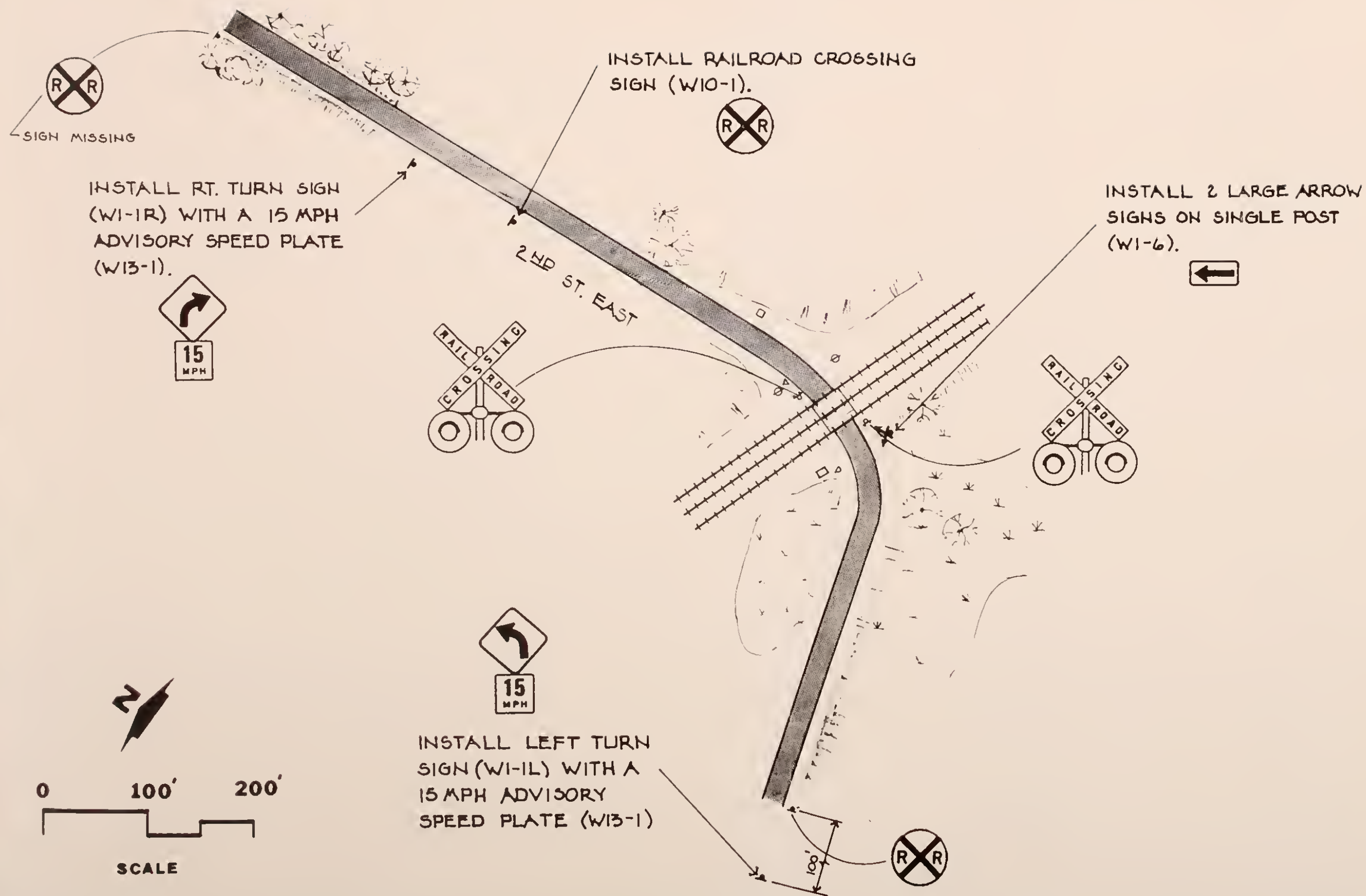
$$\underline{69.38} \times .75 + \underline{98} \times .25 = \underline{76.54}$$



SYMBOLS	
	Moving Vehicle
	Backing Vehicle
	Pedestrian Path
	Parked Vehicle
	Fixed Object
	Fatal Accident
	Injury Accident

COLLISION TYPES	
	Rear End
	Head On
	Side Swipe
	Out of Control
	Left Turn
	Right Angle

CONDITIONS	
WEATHER:	
F=Fog C=Clear R=Rain	
S=Snow SL=Sleet	
SURFACE: D=Dry W=Wet I=Icy	
TIME → 1600 7/2/82 ← DATE	
WEATHER → C D DARK ← LIGHT	
	SURFACE



Recommended Improvements

SITE NO. 6 **FLATHEAD COUNTY, MT.**

2nd St. East & B.N.R.R. Tracks

Fig. No.

6-2

SITE NO.7

.....



Site 7 East Approach



Site 7 South Approach



Site 7 South Approach



Site 7 South Approach

SITE NO. 7

CURVES AND INTERSECTION - ECHO LAKE AND JEWEL BASIN ROADS

A. DESCRIPTION

This site is located approximately two miles north of the Swan Highway (Montana Highway 83). The site is located in Section 4, Range 19 West, Township 27 North. All roadways are paved with a 24-foot width. South of the intersection, Echo Lake Road winds through a low density residential development of year-round and summer homes. There are a number of driveway accesses throughout the section.

The road is a major access to the Echo Lake recreation area and during the summer months, is traveled by drivers who are unfamiliar with the road.

The 1988 average daily traffic at the site is as follows:

North leg - 75 vpd

South leg - 205 vpd

East leg - 140 vpd

West leg - 35 vpd (private access)

The existing site characteristics are shown on Figure 7-1.

B. ACCIDENT ANALYSIS

Six accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

- * Three accidents were during daylight hours and three at night.
- * Road conditions were dry when five of the accidents occurred.
- * Three of the accidents involved single vehicles leaving the road, two were sideswipe collisions, and one involved a backing vehicle.
- * Four of the accidents resulted in injuries.
- * The investigating officers' analysis attributed the accidents to the following factors: reckless driving, speed too fast for existing conditions, and failure to drive to right of roadway.
- * Alcohol was involved in three of the accidents.

Accident diagrams are shown on Figure 7-1. Table 7-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. Fifty percent of the accidents involved single vehicles leaving the road at various curve locations.
2. Three of the accidents were sideswipes or backing accidents. The sideswipe accident involved vehicles failing to drive on the right side of the road on the various curves.
3. There is no well defined cluster of accidents involving vehicles leaving the road at a specific location.
4. The curves on the winding road section for a distance of approximately 0.25 miles south of the site were ball banked at 25 mph.

D. RECOMMENDATIONS

The following improvements are recommended for this site.

1. Trim trees on the northeast quadrant of the intersection.

2. Reset the STOP sign (R1-1) located on the west side of the intersection at the point of access of a private road.
3. Install a large double arrow (W1-7) on the west side of the intersection.
4. Install a winding road sign (W1-5) with a 25 MPH advisory speed plate (W13-1) for southbound traffic, south of the intersection (Figure 7-2)
5. Install a winding road sign (W1-5) with a 25 MPH advisory speed plate (W13-1) for northbound traffic at a location approximately 0.25 miles south of the site. The exact location is to be determined in the field.
6. Remove all 35 MPH speed limit signs between the two winding road signs.
7. Remove SCHOOL BUS STOP AHEAD sign on the east leg of the intersection and replace with a STOP SIGN AHEAD sign (W13-1a).

The recommended improvements are shown in Figure 7-2.

E. COST

1.	Trim trees	\$100.00
2.	Reset existing STOP sign (R1-1)	(maintenance)
3.	Install large double arrow sign (W1-7)	140.00
4.	Install two winding road signs (W1-5) with 25 MPH advisory speed plates (W13-1)	280.00
5.	Install STOP SIGN AHEAD sign (W3-1a)	<u>140.00</u>
TOTAL COST		\$660.00

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 66.80. The priority index is 74.85. The calculations are shown in Table 7-2.

ACCIDENT SUMMARY

SITE NUMBER 7

ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
2	1	2	1

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
1		1		2	2	

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
			1			2	1		1		1

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2			1										1					1	1				

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day- Night	Dark	Dawn	Dusk
3	3		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
5			1	

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
5	1		

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side- swipe	Non-Col	Head- on	Backing
			1		1	2	1		1

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right- of-Way	Improper Passing	Improper Backing	Improper Turning	Other
1	1	1	1			1		1

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
1		2	1
1	1		

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

3

TABLE 7-2
HAZARD INDEX CALCULATION

Site Number 7 Date _____

Site Description Echo Lake Road - Curves

Indicator	Data Value		Indicator Value		Weight		Partial H.I.s
No. of Accidents	<u>1.5</u>	acc/yr	<u>33</u>	X	0.164	=	<u>5.41</u>
Accident Rate	<u>18.06</u>	acc/MVE	<u>100</u>	X	0.225	=	<u>22.50</u>
Accident Severity	<u>9,883</u>	dollars	<u>61</u>	X	0.191	=	<u>13.72</u>
Volume/Capacity Ratio	<u>0.08</u>		<u>25</u>	X	0.082	=	<u>2.05</u>
Sight Distance Ratio	<u>0.66</u>	(wt.avg.)	<u>77</u>	X	0.074	=	<u>5.70</u>
Driver Expectancy	<u>4</u>	(wt.avg.)	<u>66</u>	X	0.149	=	<u>9.83</u>
Information System Deficiencies	<u>4</u>	(wt.avg.)	<u>66</u>	X	0.115	=	<u>7.59</u>

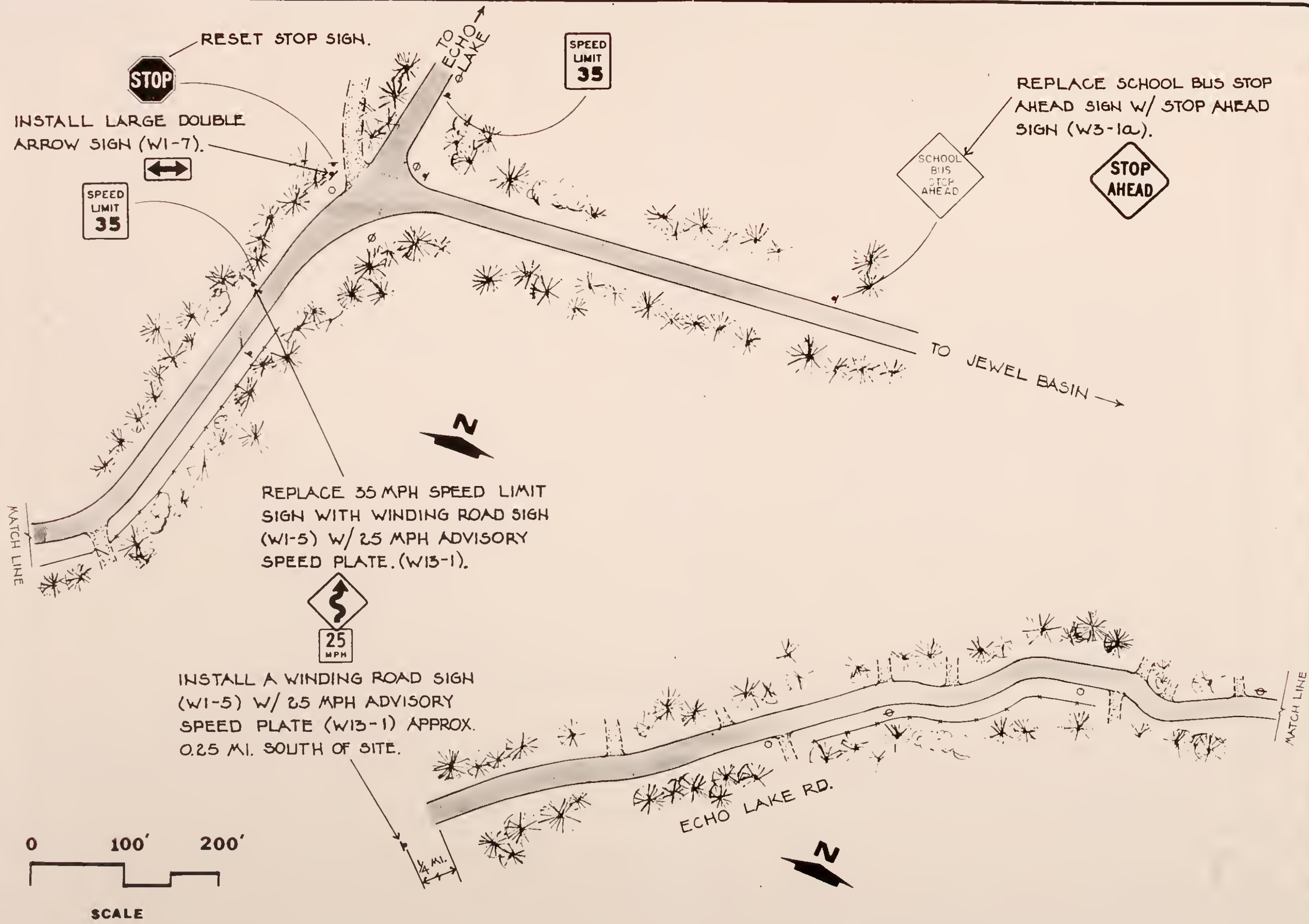
Hazard Index: 66.80

Cost of Recommended Improvements: \$660.00

Cost Factor: 99

Priority Index = Hazard Index x .75 + Cost Factor x .25

$$\underline{66.80} \times .75 + \underline{99} \times .25 = \underline{74.85}$$



SITE NO.8



Site 8 South Approach



Site 8 Midcurve Looking West



Site 8 Midcurve Looking West



Site 8 West Approach

SITE NO. 8

ECHO LAKE ROAD - CURVE

A. DESCRIPTION

This site is located approximately 0.25 miles north of the intersection of Echo Lake Road and Jewel Basin Road. The site is located in Section 4, Range 19 West, Township 27 North. The site is a 90-degree curve in the Echo Lake access road, leading into a steep downhill grade (10.8 percent). The south approach to the curve is signed with a turn left turn (W1-1L) with a 15 MPH advisory speed plate (W13-1). The curve has a large arrow sign (W1-6) with six-foot flexible delineators. There is a 35 MPH speed limit sign on the west approach.

The 1988 average daily traffic at this site is 75 vpd.

The existing site characteristics are shown on Figure 8-1.

B. ACCIDENT ANALYSIS

Three accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that

are pertinent in determining factors that may have contributed to the accidents:

- * Two accidents occurred after dark.
- * All accidents involved single vehicles leaving the roadway.
- * Road conditions were dry and weather was clear when the accidents occurred.
- * Two vehicles collided with a fence and one with a tree.
- * Two of the accidents resulted in injuries.
- * The investigating officers' analysis attributed the accidents to the following factors: careless driving and alcohol.
- * Alcohol was involved in two of the accidents.

Accident diagrams are shown on Figure 8-1. Table 8-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. All accidents involved single vehicles leaving the road. Two were northbound into the curve and one occurred at the bottom of the hill involving an eastbound vehicle.

D. RECOMMENDATIONS

The following improvements are recommended for this site.

1. Relocate the existing large arrow sign (W1-6) and add another large arrow sign on the same post for eastbound traffic.
2. Remove the existing 35 MPH speed limit sign on the west approach and replace with a 25 MPH speed limit sign.
3. Add two six-foot flexible delineators to the east end of the existing delineator line with the same spacing as the existing delineators.

The recommended improvements are shown in Figure 8-2.

E. COST

1. Install two large arrow signs (W1-6)	\$280.00
2. Install 25 MPH speed limit sign (R2-1)	140.00
3. Install two 6-ft. flexible delineators	<u>40.00</u>

TOTAL COST	\$460.00
------------	----------

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 62.08. The priority index is 69.56. The calculations are shown in Table 8-2.

ACCIDENT SUMMARY

SITE NUMBER 8 ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
1	1	1	

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
		1			1	1

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						1	1			1	

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
2																			1				

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day-light	Dark	Dawn	Dusk
1	2		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
3				

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
3			

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side-swipe	Non-Col	Head-on	Backing
			3						

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right-of-Way	Improper Passing	Improper Backing	Improper Turning	Other
1	1							1

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
1			
	1	1	

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

2

TABLE 8-2
HAZARD INDEX CALCULATION

Site Number 8 Date _____

Site Description Echo Lake Road - Curve

Indicator	Data Value		Indicator Value		Weight		Partial H.I.s
No. of Accidents	<u>0.75</u>	acc/yr	<u>15</u>	X	0.164	=	<u>2.46</u>
Accident Rate	<u>27.40</u>	acc/MVE	<u>100</u>	X	0.225	=	<u>22.50</u>
Accident Severity	<u>12,400</u>	dollars	<u>68</u>	X	0.191	=	<u>12.99</u>
Volume/Capacity Ratio	<u>0.03</u>		<u>14</u>	X	0.082	=	<u>1.15</u>
Sight Distance Ratio	<u><.50</u>	(wt.avg.)	<u>100</u>	X	0.074	=	<u>7.40</u>
Driver Expectancy	<u>4</u>	(wt.avg.)	<u>66</u>	X	0.149	=	<u>9.83</u>
Information System Deficiencies	<u>3</u>	(wt.avg.)	<u>50</u>	X	0.115	=	<u>5.75</u>

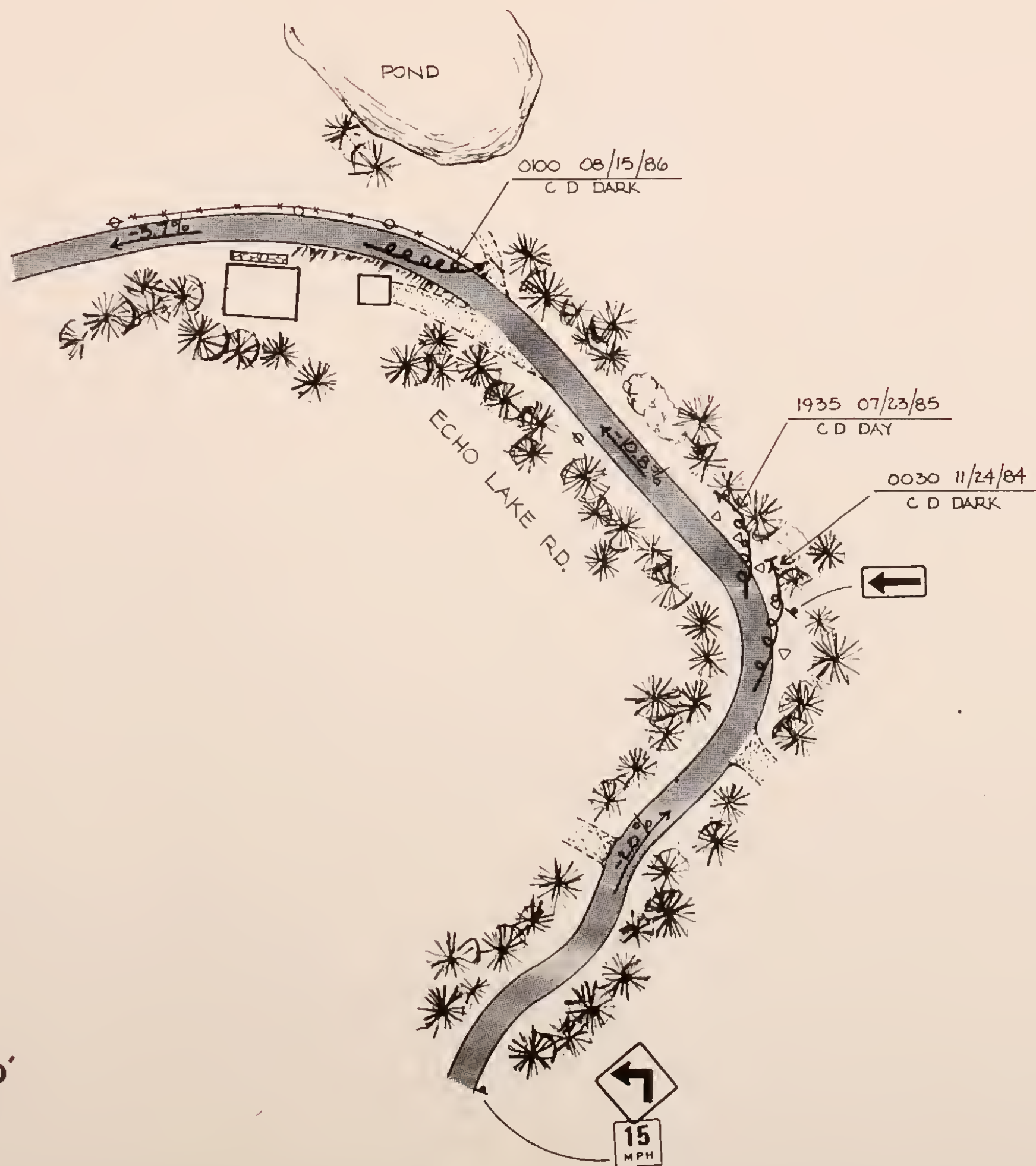
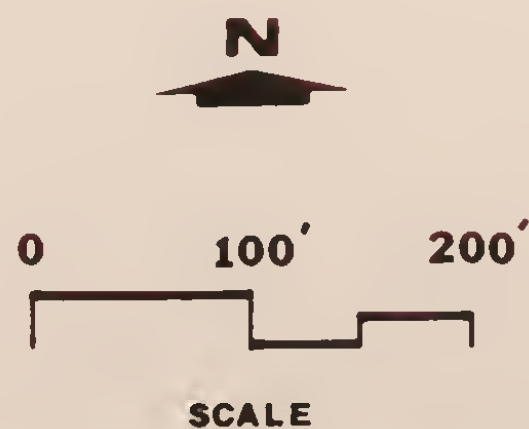
Hazard Index: 62.08

Cost of Recommended Improvements: \$460.00

Cost Factor: 92

Priority Index = Hazard Index x .75 + Cost Factor x .25

$$\underline{62.08} \times .75 + \underline{92} \times .25 = \underline{69.56}$$



SYMBOLS	
	Moving Vehicle
	Backing Vehicle
	Pedestrian Path
	Parked Vehicle
	Fixed Object
	Fatal Accident
	Injury Accident

COLLISION TYPES	
	Rear End
	Head On
	Side Swipe
	Out of Control
	Left Turn
	Right Angle

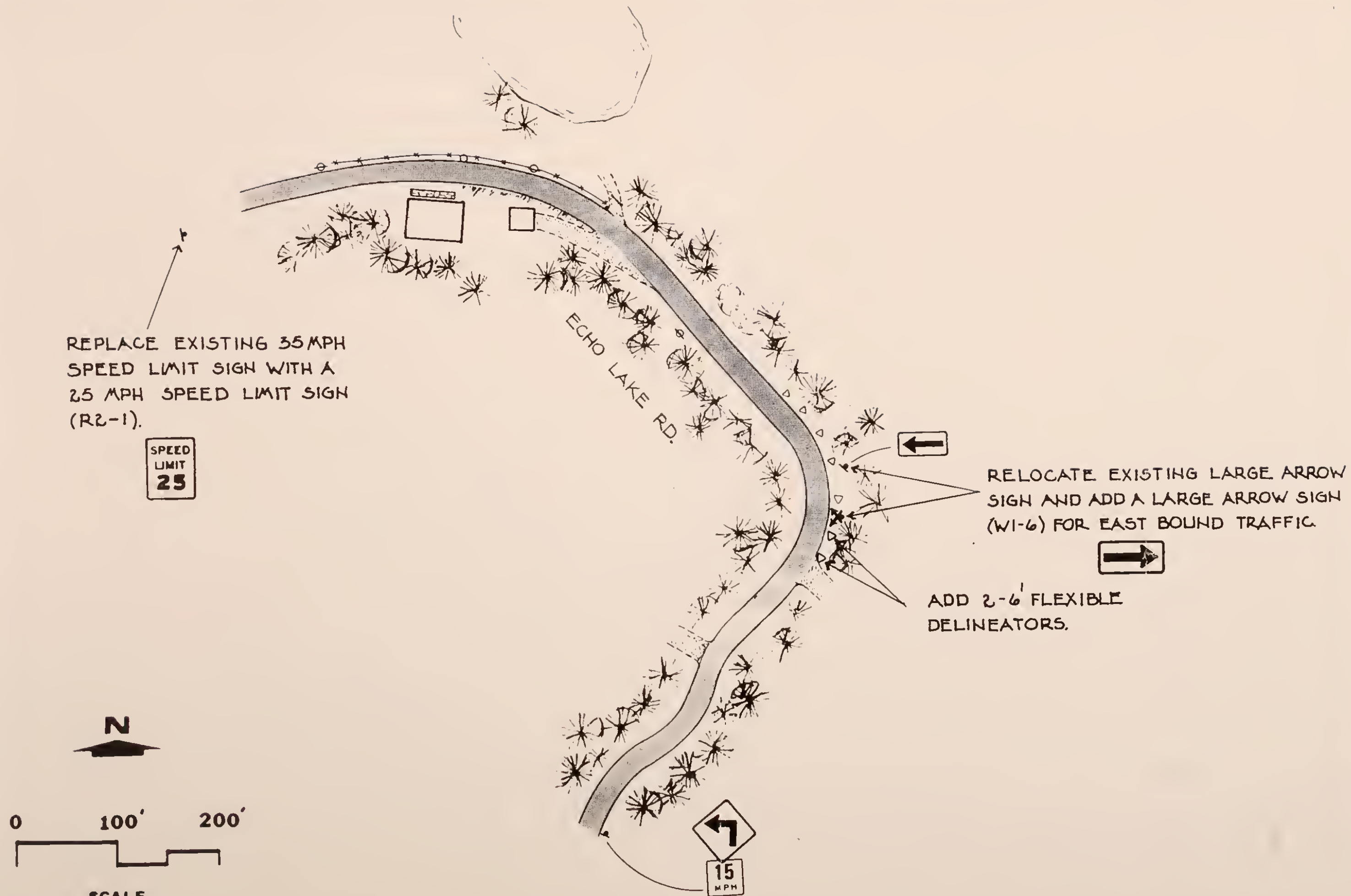
CONDITIONS	
WEATHER:	
F=Fog C=Clear R=Rain	
S=Snow SL=Slush	
SURFACE: D=Dry W=Wet I=Icy	
TIME → 1600 7/2/82 ← DATE	
WEATHER → C D ← DARK ← LIGHT	
	SURFACE

Existing Conditions & Accidents

SITE NO. 8

FLATHEAD COUNTY, MT.

Echo Lake Road



SITE NO.9

.....



Site 9 North Approach

SITE NO. 9

FOOTHILL ROAD - CURVE

A. DESCRIPTION

This site is located at the west half section point on the west boundary of Section 20, Range 19 West, Township 28 North. From the east approach the paved roadway curves to the north in a long curve. There are several farmsteads along this section of road. A gravel access road intersects at mid curve.

The 1988 average daily traffic at this site is 130 vpd.

The existing site characteristics are shown on Figure 9-1.

B. ACCIDENT ANALYSIS

Four accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

- * Two accidents occurred during daylight and two during dark or dusk hours.
- * All accidents involved single vehicles leaving the roadway.
- * Road conditions were dry and weather was clear when all the accidents occurred.
- * One accident occurred with an officer in pursuit.
- * One accident involved collision with a deer and one with a tree.
- * Vehicles overturned in two of the accidents.
- * Three of the accidents resulted in injuries.
- * The investigating officers' analysis attributed the accidents to careless driving.
- * Alcohol was involved in one of the accidents.

Accident diagrams are shown on Figure 9-1. Table 9-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. The primary cause of accidents at this location appears to be lack of observance of the curve signs on each approach which have an advisory speed of 35 MPH. The curve was ball banked at this speed.

D. RECOMMENDATIONS

The following improvements are recommended for this site.

1. Install two large arrow signs on curve as shown on Figure 9-2.

E. COST

- | | |
|---|----------|
| 1. Install two large arrow signs (W1-6) | \$280.00 |
|---|----------|

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 62.71. The priority index is 71.78. The calculations are shown in Table 9-2.

ACCIDENT SUMMARY

SITE NUMBER 9 ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
	3	1	

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
1		1		1	1	

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
		1		1	2						

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
						1										1					1		1

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day-light	Dark	Dawn	Dusk
2	1		1

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
4				

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
4			

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side-swipe	Non-Col	Head-on	Backing
			1		1		2		

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right-of-Way	Improper Passing	Improper Backing	Improper Turning	Other
2								2

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
	2	1	
	1		

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

1

TABLE 9-2
HAZARD INDEX CALCULATION

Site Number 9 Date _____

Site Description Foothill road - Curve

Indicator	Data Value		Indicator Value	Weight		Partial H.I.s
No. of Accidents	<u>1.0</u>	acc/yr	<u>25</u>	X 0.164	=	<u>4.10</u>
Accident Rate	<u>21.07</u>	acc/MVE	<u>100</u>	X 0.225	=	<u>22.50</u>
Accident Severity	<u>9,275</u>	dollars	<u>61</u>	X 0.191	=	<u>11.65</u>
Volume/Capacity Ratio	<u>0.05</u>		<u>18</u>	X 0.082	=	<u>1.48</u>
Sight Distance Ratio	<u><.50</u>	(wt.avg.)	<u>100</u>	X 0.074	=	<u>7.40</u>
Driver Expectancy	<u>4</u>	(wt.avg.)	<u>66</u>	X 0.149	=	<u>9.83</u>
Information System Deficiencies	<u>3</u>	(wt.avg.)	<u>50</u>	X 0.115	=	<u>5.75</u>

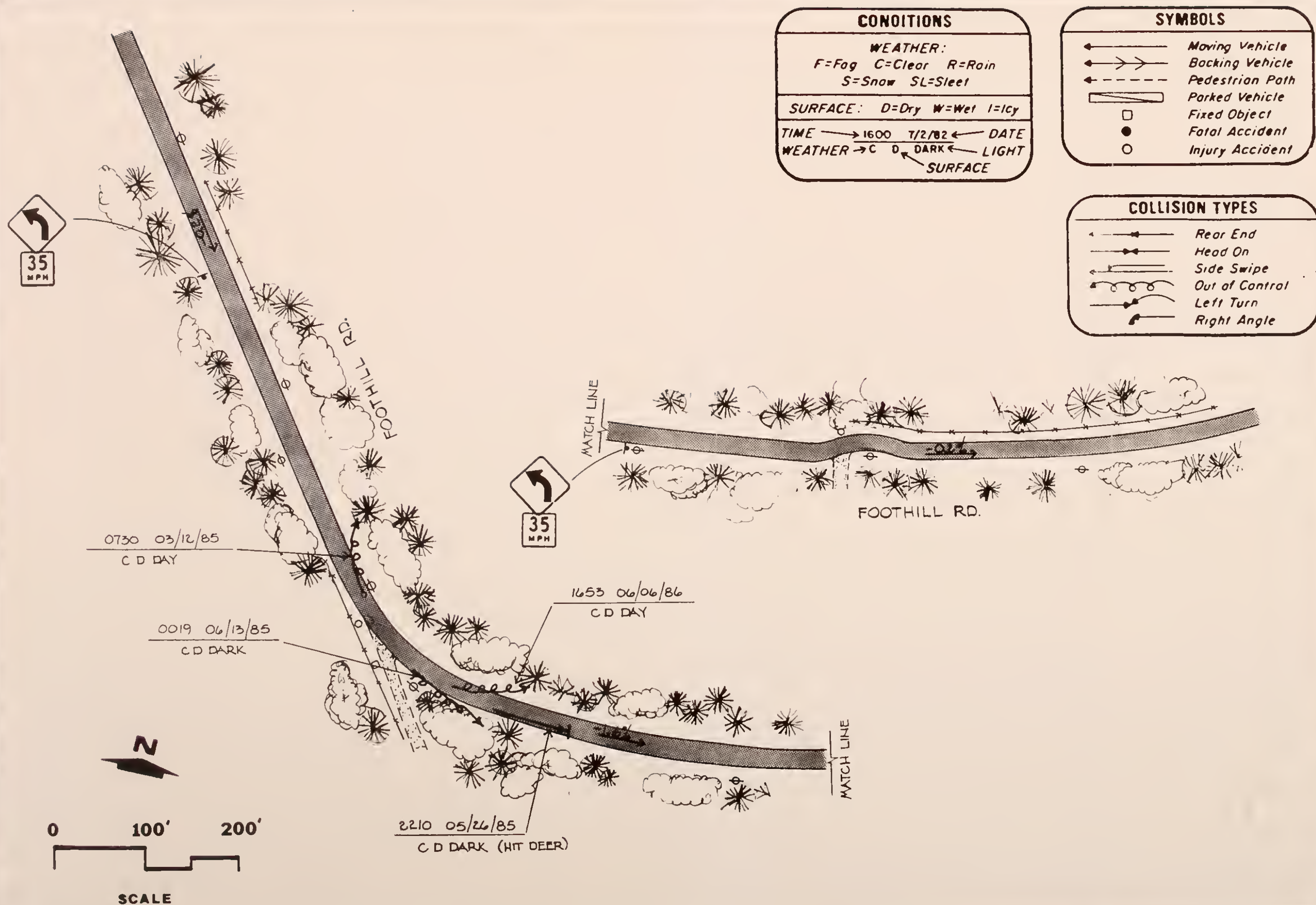
Hazard Index: 62.71

Cost of Recommended Improvements: \$240.00

Cost Factor: 99

Priority Index = Hazard Index x .75 + Cost Factor x .25

$$\underline{62.71} \times .75 + \underline{99} \times .25 = \underline{71.78}$$





Recommended Improvements

SITE NO. 9
FLATHEAD COUNTY, MT.

Foothill Road

Fig. No.

9-2

SITE NO.10

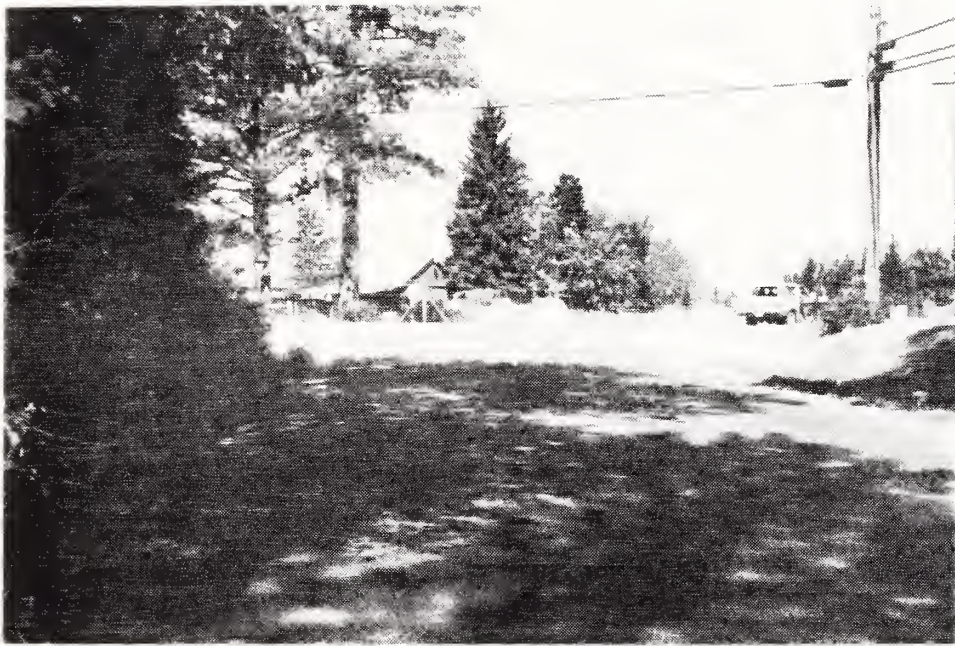




Site 10 West Approach



Site 10 West Approach



Site 10 East Approach



Site 10 North Approach

SITE NO. 10

INTERSECTION OF TALBOT ROAD AND 4TH AVENUE - COLUMBIA FALLS

A. DESCRIPTION

This site is located on the southeast edge of Columbia Falls. Talbot Road intersects Fourth Avenue at a curve. The intersection is basically a T intersection; however, two large trees and some abandoned mailboxes are located on a median within the intersection. Two-way traffic flows on the north and south sides of the median. There is a private sign on the south side of the intersection displaying a red, double arrow "Courtesy of Glacier Towing."

The 1988 average daily traffic at this site is as follows:

North leg - 610 vpd

West leg - 265 vpd

East leg - 635 vpd

The existing site characteristics are shown on Figure 10-1.

B. ACCIDENT ANALYSIS

Three accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

- * Two accidents occurred during daylight hours.
- * Road conditions were dry and weather was clear when two of the accidents occurred; the other accident occurred on an icy road.
- * Two of the accidents involved the collision of two vehicles.
- * Two of the accidents resulted in injuries.
- * The investigating officers' analysis attributed the accidents to careless driving.

Accident diagrams are shown on Figure 10-1. Table 10-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. Two of the accidents were collisions resulting from vehicles maneuvering around the obstacles within the intersection. The other accident was a collision with one of the large trees located in the median of the intersection.

D. RECOMMENDATIONS

The following improvements are recommended for this site. The major contributor to accidents at this location is the design of the intersection. The most positive approach to solving the existing problem would be to remove the trees and abandoned mailboxes in the intersection and to reconstruct the intersection as a T intersection with a STOP sign on the west leg. Evidently, there has been opposition to the removal of the two large trees. An alternative would be to remove the tree on the south side of the median which would widen the east-bound lane through the intersection. In lieu of the foregoing improvements, the following short-term improvements are recommended:

1. Remove abandoned mailboxes and clean up median.

2. Install a T symbol sign (W2-4) on the west approach to the intersection.
3. Replace the YIELD sign (R1-2) with a STOP sign (R1-1) on the west approach for eastbound traffic.
4. Install a large double arrow sign (W1-7) on the south side of the intersection.

The recommended improvements are shown in Figure 10-2.

E. COST

1. Remove abandoned mailboxes and clean up median (maintenance)	
2. Install T symbol sign (W2-4) on west approach	\$140.00
3. Replace YIELD sign with STOP sign (R1-1)	140.00
4. Install large double arrow sign (W1-7)	<u>140.00</u>
TOTAL:	\$420.00

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 44.13. The priority index is 57.85. The calculations are shown in Table 10-2.

ACCIDENT SUMMARY

SITE NUMBER 10 ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
2	1		

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
		1	1		1	

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1					1			1			

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
															1			1					1

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day-light	Dark	Dawn	Dusk
2	1		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
2			1	

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
3			

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side-swipe	Non-Col	Head-on	Backing
1			1					1	

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right-of-Way	Improper Passing	Improper Backing	Improper Turning	Other
2								1

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
2			
	1		

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

0

TABLE 10-2
HAZARD INDEX CALCULATION

Site Number 10 Date _____

Site Description Intersection of Talbot Road and Fourth Avenue
South Columbia Falls

Indicator	Data Value		Indicator Value	Weight		Partial H.I.s
No. of Accidents	<u>0.75</u>	acc/yr	<u>17</u>	X 0.164	=	<u>2.79</u>
Accident Rate	<u>2.72</u>	acc/MVE	<u>45</u>	X 0.225	=	<u>10.12</u>
Accident Severity	<u>4,633</u>	dollars	<u>38</u>	X 0.191	=	<u>7.26</u>
Volume/Capacity Ratio	<u>0.25</u>		<u>41</u>	X 0.082	=	<u>3.36</u>
Sight Distance Ratio	<u><.50</u>	(wt.avg.)	<u>100</u>	X 0.074	=	<u>7.40</u>
Driver Expectancy	<u>3</u>	(wt.avg.)	<u>50</u>	X 0.149	=	<u>7.45</u>
Information System Deficiencies	<u>3</u>	(wt.avg.)	<u>50</u>	X 0.115	=	<u>5.75</u>

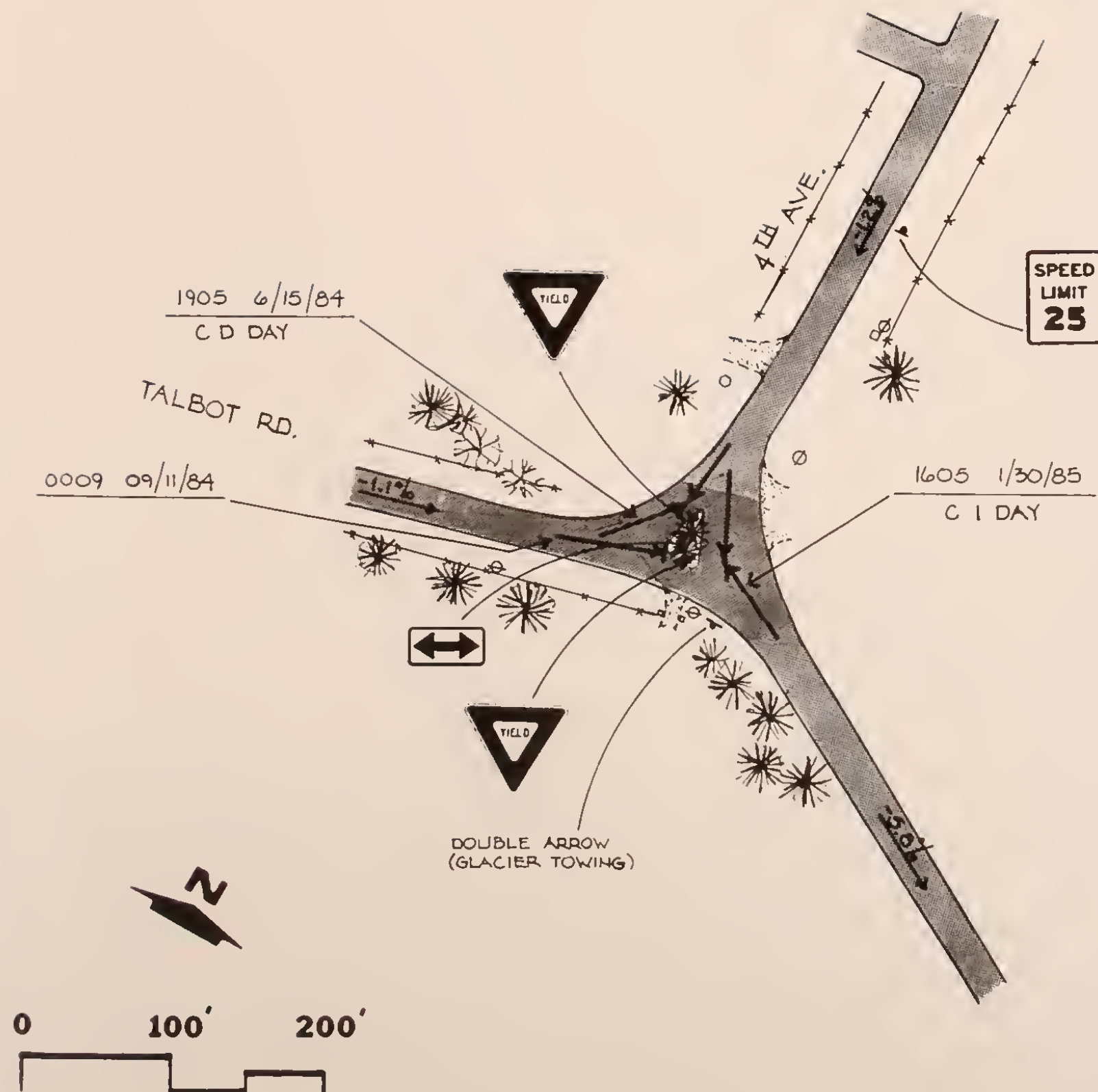
Hazard Index: 44.13

Cost of Recommended Improvements: \$420.00

Cost Factor: 99

Priority Index = Hazard Index x .75 + Cost Factor x .25

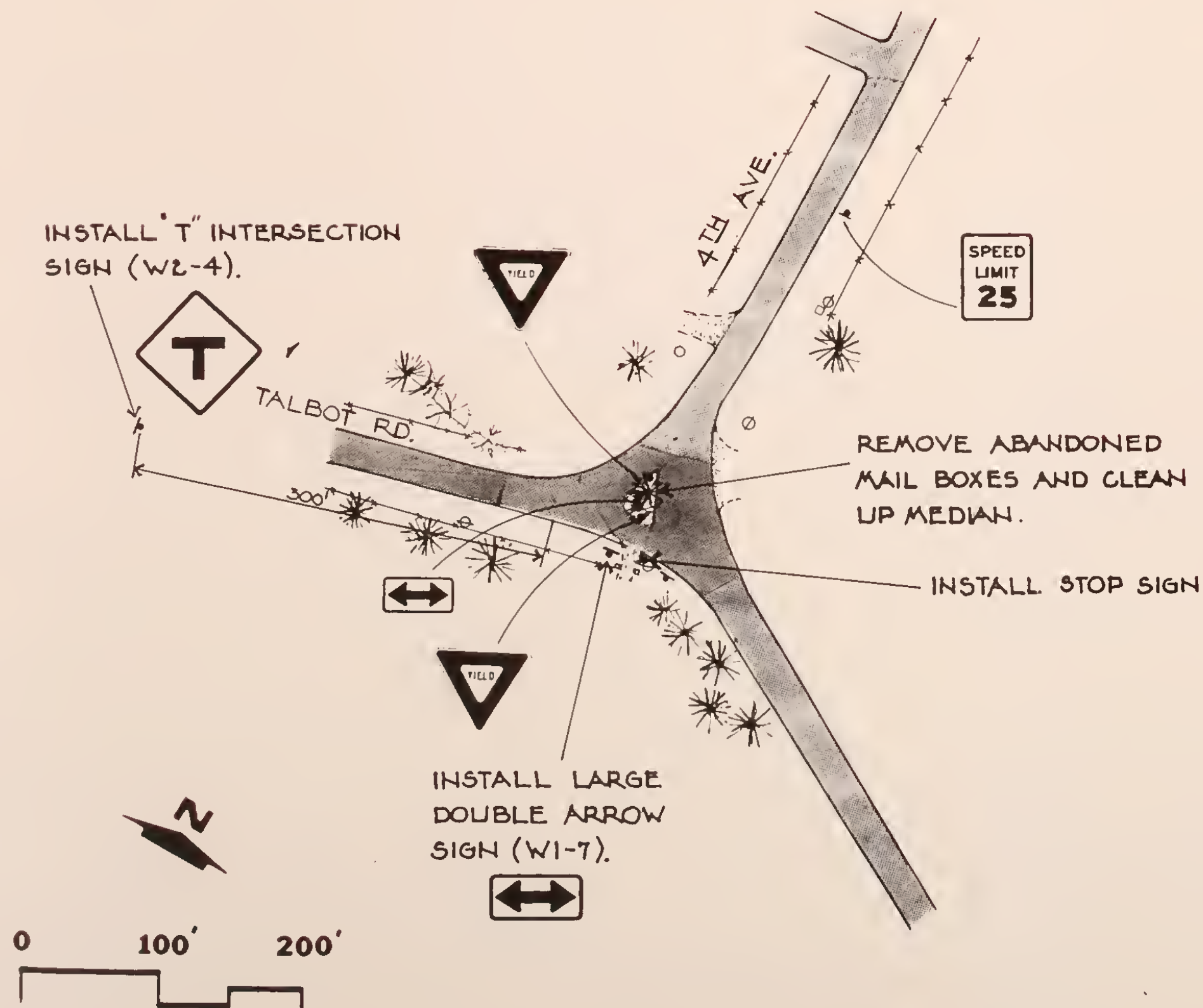
$$\underline{44.13} \times .75 + \underline{99} \times .25 = \underline{57.85}$$



SYMBOLS	
	Moving Vehicle
	Backing Vehicle
	Pedestrian Path
	Parked Vehicle
	Fixed Object
	Fatal Accident
	Injury Accident

COLLISION TYPES	
	Rear End
	Head On
	Side Swipe
	Out of Control
	Left Turn
	Right Angle

CONDITIONS	
WEATHER:	
F=Fog C=Clear R=Rain	
S=Snow SL=Slush	
SURFACE: D=Dry W=Wet I=Icy	
TIME → 1600 7/2/82 ← DATE	
WEATHER → C D ← DARK ← LIGHT	
	SURFACE



LONG RANGE IMPROVEMENTS:
 REMOVE ISLAND TREES AND
 RECONSTRUCT AS A "T" INTERSECTION
 WITH A STOP SIGN ON WEST
 APPROACH.

SITE NO. 10 **FLATHEAD COUNTY, MT.**

Recommended Improvements

Talbot Road & 4th Ave.

Fig. No.

10-2

SITE NO. 11
.....



Site 11 Midcurve-Steep bank



Site 11 South Approach



Site 11 North Approach



Site 11 South Approach

SITE NO. 11

COLUMBIA FALLS STAGE ROAD - CURVE

A. DESCRIPTION

This site is a curve located on the Columbia Falls Stage Road approximately 1/2 mile north of its intersection with Montana Highway 35. The site is located in Section 32, Range 20 West, Township 29 North. The location is on a curve that parallels a slough to the west of the roadway. The road is paved with a 24-foot width.

The 1988 average daily traffic at this site is 250 vpd.

The existing site characteristics are shown on Figure 11-1.

B. ACCIDENT ANALYSIS

Six accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

* Four accidents were during hours of darkness.

- * Four accidents occurred during snowy or icy road conditions.
- * Four accidents occurred during rainy, snowy, or foggy weather conditions.
- * Five of the accidents involved a single vehicle leaving the roadway.
- * Five of the vehicles collided with fixed objects; three collided with a utility pole, one with a tree, and one with a parked vehicle.
- * The investigating officers' analysis attributed the accidents to the following factors: careless driving, and speed too fast for conditions.
- * Alcohol was involved in one of the accidents.

Accident diagrams are shown on Figure 11-1. Table 11-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. Sixty-seven percent of the accidents occurred after dark during rain, snow, or foggy weather conditions and snowpacked or icy road conditions. The primary cause of the accidents was speed too fast for the prevailing conditions.
2. Sixty-seven percent of the vehicles involved in accidents were southbound. The southbound approach to the curve is a long tangent section on which most traffic appears to be traveling at or above the posted speed limit of 45 MPH.

D. RECOMMENDATIONS

The following improvements are recommended for this site:

1. Install twelve six-foot flexible delineators around the north curve for southbound traffic.

The recommended improvements are shown in Figure 11-2.

E. COST

- | | |
|--|----------|
| 1. Install 12 6-ft. flexible delineators | \$240.00 |
|--|----------|

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 60.32. The priority index is 60.99. The calculations are shown in Table 11-2.

ACCIDENT SUMMARY

SITE NUMBER 11 ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
1		3	2

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
1		1			3	1

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	1	1	1						1		2

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	1						2									2							1

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day-light	Dark	Dawn	Dusk
2	4		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
2		1	2	1

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
2	1	2	1

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side-swipe	Non-Col	Head-on	Backing
			5				1		

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right-of-Way	Improper Passing	Improper Backing	Improper Turning	Other
4			1					1

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
		1	1
1		2	1

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

1

TABLE 11-2
HAZARD INDEX CALCULATION

Site Number 11 Date _____

Site Description Columbia Falls Stage Road - Curve

Indicator	Data Value		Indicator Value		Weight		Partial H.I.s
No. of Accidents	<u>1.5</u>	acc/yr	<u>25</u>	X	0.164	=	<u>4.10</u>
Accident Rate	<u>16.44</u>	acc/MVE	<u>100</u>	X	0.225	=	<u>22.50</u>
Accident Severity	<u>13,750</u>	dollars	<u>71</u>	X	0.191	=	<u>13.56</u>
Volume/Capacity Ratio	<u>0.10</u>		<u>27</u>	X	0.082	=	<u>2.21</u>
Sight Distance Ratio	<u>1.0</u>	(wt.avg.)	<u>32</u>	X	0.074	=	<u>2.37</u>
Driver Expectancy	<u>4</u>	(wt.avg.)	<u>66</u>	X	0.149	=	<u>9.83</u>
Information System Deficiencies	<u>3</u>	(wt.avg.)	<u>50</u>	X	0.115	=	<u>5.75</u>
Hazard Index:							<u>60.32</u>
Cost of Recommended Improvements:							<u>\$240.00</u>
Cost Factor:							<u>99</u>

Priority Index = Hazard Index x .75 + Cost Factor x .25

$$\underline{60.32} \times .75 + \underline{99} \times .25 = \underline{69.99}$$



SPEED
LIMIT
45



0830 12/13/86
S I DARK

1730 12/14/86
S I DARK

0819 2/6/87
F I DAY
COLUMBIA FALLS STAGE RD.

1650 3/27/87
S I DAY

0200 10/18/86
C D DARK

0015 4/24/84
C D DARK

SYMBOLS

- Moving Vehicle
- Backing Vehicle
- Pedestrian Path
- Parked Vehicle
- Fixed Object
- Fatal Accident
- Injury Accident

COLLISION TYPES

- Rear End
- Head On
- Side Swipe
- Out of Control
- Left Turn
- Right Angle

CONDITIONS

WEATHER:
F=Fog C=Clear R=Rain
S=Snow SL=Sleet

SURFACE: D=Dry W=Wet I=Icy

TIME → 1600 7/2/82 ← DATE
WEATHER → C D DARK ← LIGHT
SURFACE

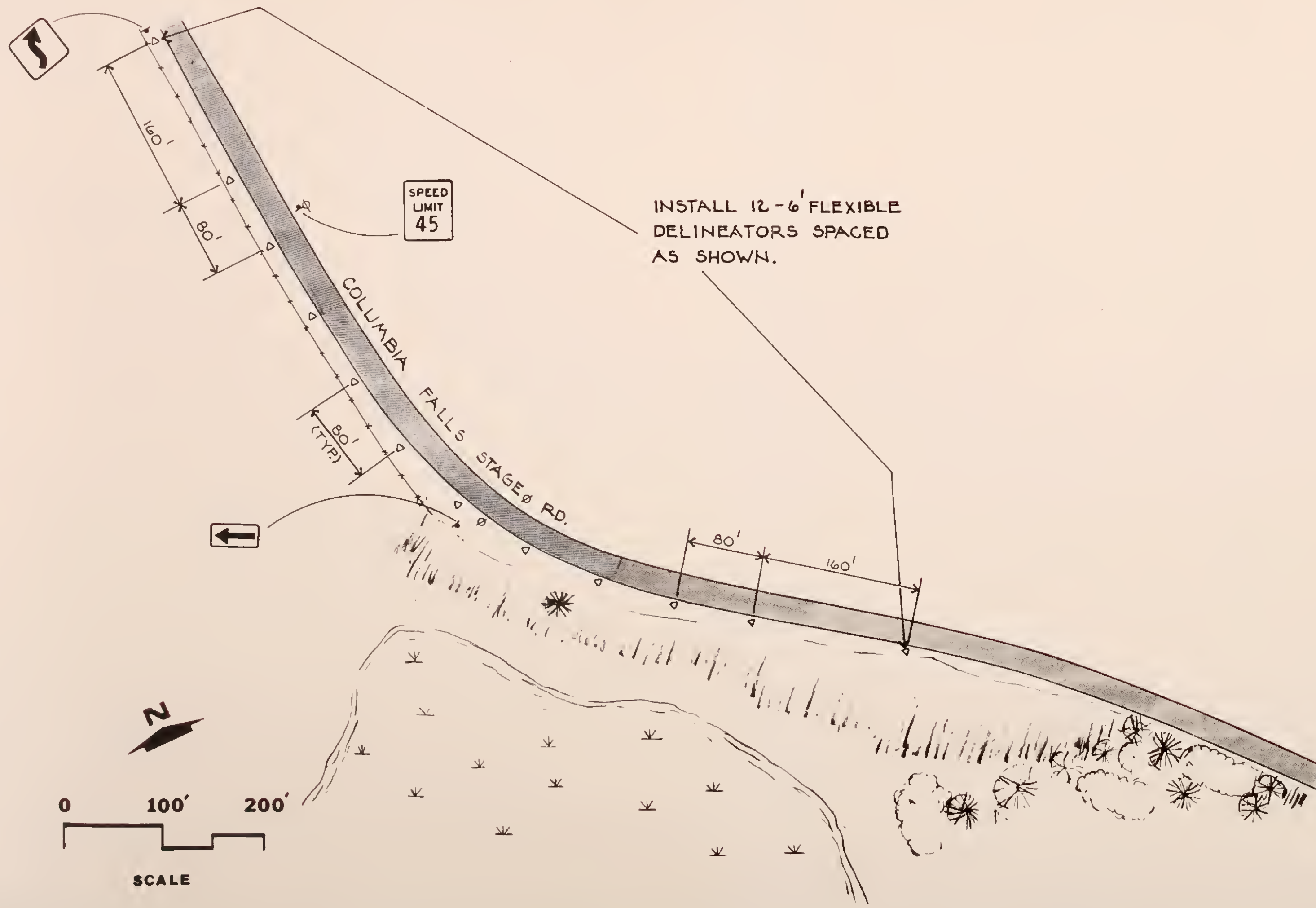
SITE NO. 11

FLATHEAD COUNTY, MT.

Existing Conditions & Accidents

Columbia Falls Stage Road

Fig. No.
11-1



Recommended Improvements

SITE NO. 11
FLATHEAD COUNTY, MT.

Columbia Falls Stage Road

Fig. No.

11-2

SITE NO.12





Site 12 North Approach



Site 12 South Approach



Site 12 Midcurve Looking South



Site 12 South Approach

SITE NO. 12

WEST VALLEY DRIVE - CURVE

A. DESCRIPTION

This site is a sharp curve around a hill on West Valley Drive approximately 1/8 mile north of its intersection with U.S. Highway 2. The site is located in Section 16, Range 22 West, Township 28 North. The curve is signed with a reverse curve sign with a 15 MPH advisory speed plate on both approaches. The hill, located on the east side of the road, restricts sight distance from both approaches.

The 1988 average daily traffic at this site is 125 vpd.

The existing site characteristics are shown on Figure 12-1.

B. ACCIDENT ANALYSIS

Four accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

- * The accidents were evenly distributed during dark and daylight hours.
- * All accidents occurred on a dry road.
- * All accidents involved a single vehicle leaving the roadway.
- * Two of the vehicles rolled over.
- * Three vehicles struck a fence.
- * The investigating officers' analysis attributed the accidents to the following factors: careless driving, speed too fast for conditions and defective tires or wheels, and drinking.
- * Alcohol was involved in one of the accidents.

Accident diagrams are shown on Figure 12-1. Table 12-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. The accidents were evenly divided between north- and southbound vehicles.
2. The probable cause of the accidents was excessive speed. The curve is the first curve encountered by northbound traffic.

D. RECOMMENDATIONS

The following improvements are recommended for this site:

1. Clear brush on east side of road on inside of curve.
2. Install two large arrow signs on a single post on the west side of the curve (Figure 12-2).
3. Install a large arrow sign on the south approach.

The recommended improvements are shown in Figure 12-2.

E. COST

1. Clear brush	\$100.00
2. Install three large arrow signs (W1-6)	<u>420.00</u>
TOTAL COST	\$520.00

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 64.24. The priority index is 71.93. The calculations are shown in Table 12-2.

ACCIDENT SUMMARY

SITE NUMBER 12

ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
4			

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
	1	1				2

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
			1		1			2			

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
												1	1							1	1		

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day- Night	Dark	Dawn	Dusk
2	2		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
4				

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
3	1		

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side- swipe	Non-Col	Head- on	Backing
			3				1		

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right- of-Way	Improper Passing	Improper Backing	Improper Turning	Other
	1		2					1

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
3			
1			

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

1

TABLE 12-2
HAZARD INDEX CALCULATION

Site Number 12 Date _____

Site Description West Valley Drive - Curve

Indicator	Data Value		Indicator Value	Weight		Partial H.I.s
No. of Accidents	<u>1.0</u>	acc/yr	<u>25</u>	X 0.164	=	<u>4.10</u>
Accident Rate	<u>21.92</u>	acc/MVE	<u>100</u>	X 0.225	=	<u>22.50</u>
Accident Severity	<u>12,400</u>	dollars	<u>69</u>	X 0.191	=	<u>13.18</u>
Volume/Capacity Ratio	<u>0.05</u>		<u>18</u>	X 0.082	=	<u>1.48</u>
Sight Distance Ratio	<u><.50</u>	(wt.avg.)	<u>100</u>	X 0.074	=	<u>7.40</u>
Driver Expectancy	<u>4</u>	(wt.avg.)	<u>66</u>	X 0.149	=	<u>9.83</u>
Information System Deficiencies	<u>3</u>	(wt.avg.)	<u>50</u>	X 0.115	=	<u>5.75</u>

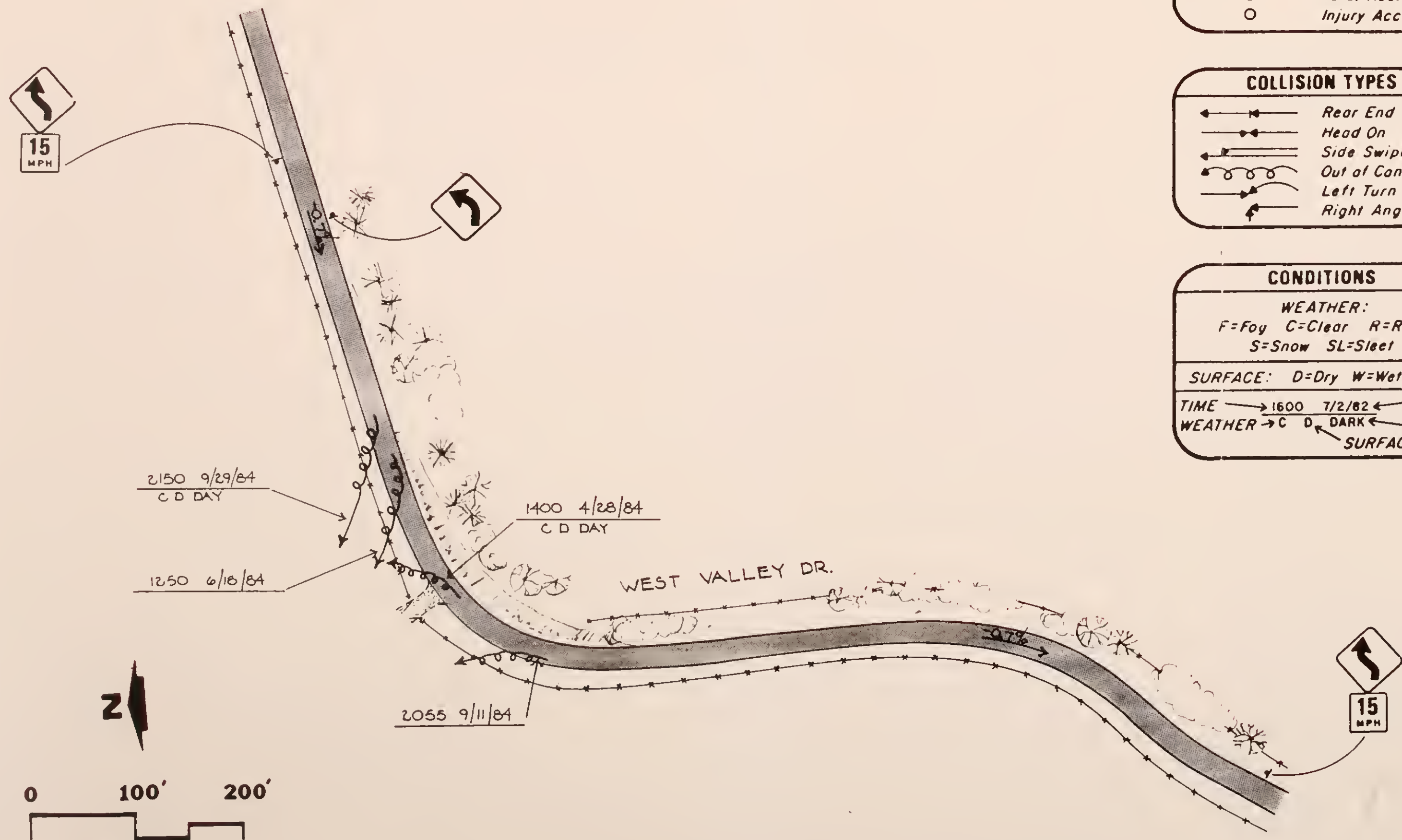
Hazard Index: 64.24

Cost of Recommended Improvements: \$520.00

Cost Factor: 95

Priority Index = Hazard Index x .75 + Cost Factor x .25

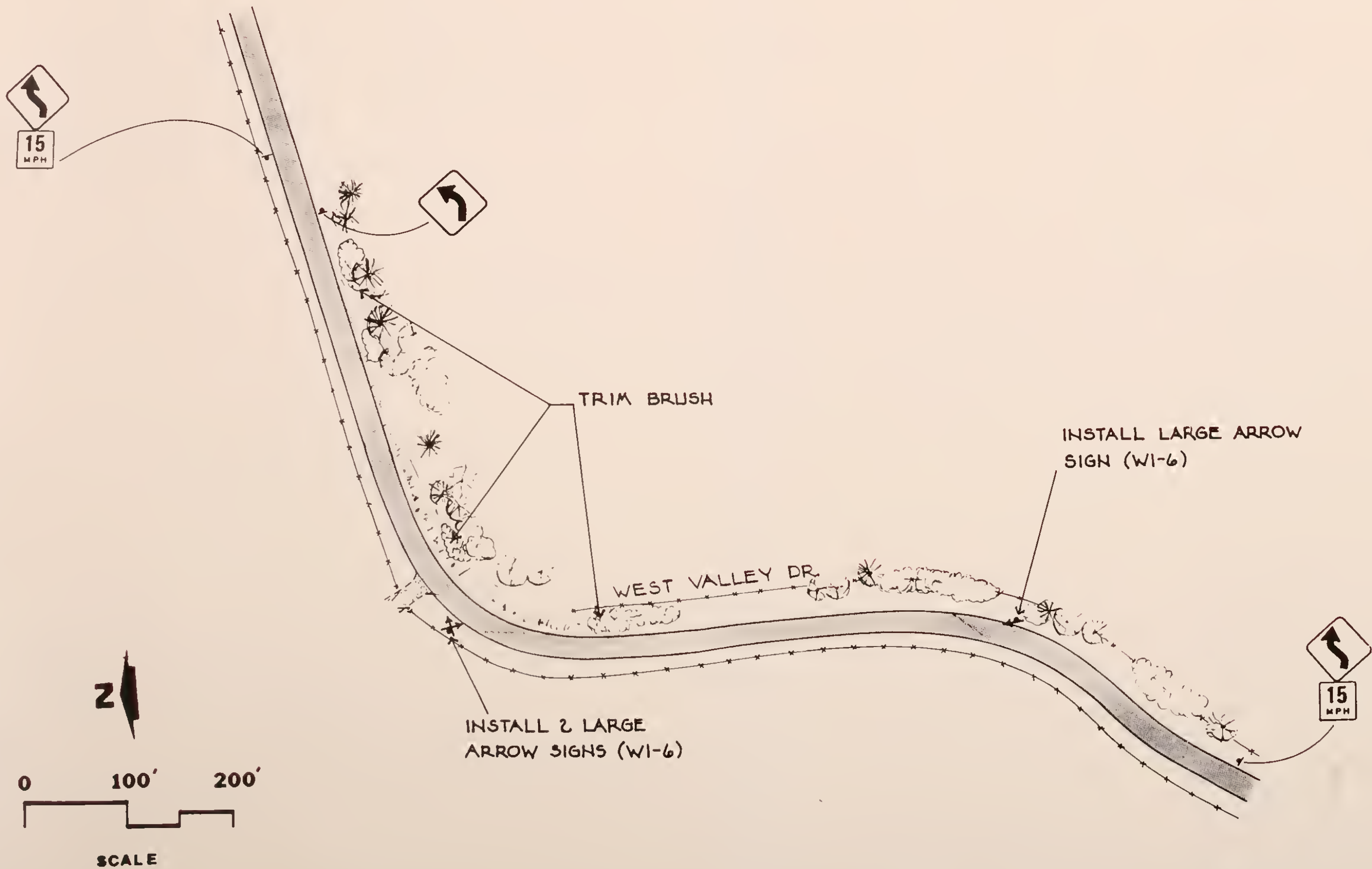
$$\underline{64.24} \times .75 + \underline{95} \times .25 = \underline{71.93}$$



SYMBOLS	
	Moving Vehicle
	Backing Vehicle
	Pedestrian Path
	Parked Vehicle
	Fixed Object
	Fatal Accident
	Injury Accident

COLLISION TYPES	
	Rear End
	Head On
	Side Swipe
	Out of Control
	Left Turn
	Right Angle

CONDITIONS	
WEATHER:	
F=Fog C=Clear R=Rain	
S=Snow SL=Sleet	
SURFACE: D=Dry W=Wet I=Icy	
TIME → 1600 7/2/82 ← DATE	
WEATHER → C D DARK ← LIGHT	
	← SURFACE



Recommended Improvements

SITE NO. 12
FLATHEAD COUNTY, MT.

West Valley Drive

Fig. No.

12-2

SITE NO. 13



Site 13 East Approach

SITE NO. 13

FOOTHILL ROAD - CURVE

A. DESCRIPTION

This site is a 90-degree curve located at the midpoint of the south boundary of Section 20, Range 19 West, Township 28 North. The road surface is gravel. At the time of this study the road was under construction. The roadbed is being raised and widened and the drainage improved.

The 1988 average daily traffic at this site is 130 vpd.

The existing site characteristics are shown on Figure 13-1.

B. ACCIDENT ANALYSIS

Four accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

* Three of the accidents occurred in daylight.

- * Two of the accidents occurred on a dry road, two occurred when the road was wet and icy.
- * Two of the accidents were angle collisions; one rear-end and one fixed object.
- * Three of the accidents involved possible violations of drinking, speed, and improper backing.
- * Two of the accidents involved injuries and two were property damage accidents.
- * The investigating officers' analysis attributed the accidents to the following factors: inattentive driving, road slippery or icy, inexperience, and failure to have vehicle under control (speed not involved).
- * Alcohol was involved in one of the accidents.

Accident diagrams are shown on Figure 13-1. Table 13-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. Two of the accidents at the curve involved the collision of meeting vehicles. Trees on the inside of the curve limit sight distance from both approaches.
2. Vehicles leaving the road at the curve were traveling too fast for prevailing conditions. The approaches on each side of the curve are long tangent sections.
3. The curve was ball banked at 15 MPH.

D. RECOMMENDATIONS

The following improvements are recommended for this site:

1. Trim tree limbs in the northeast quadrant of the curve.
2. Install right- and left-turn signs (W1-1R and -1L) with 15 MPH advisory speed plates (W13-1) on the east and north approaches to the curve.

3. Install two large arrows on the southwest side of the curve (Figure 13-2).

The recommended improvements are shown in Figure 13-2.

E. COST

1.	Trim trees	\$100.00
2.	Install right- and left-turn signs (W1-1R and W1-1L) and 15 MPH advisory speed plates (W13-1)	280.00
3.	Install two large arrow signs (W1-6)	<u>280.00</u>
TOTAL COST		\$660.00

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 66.84. The priority index is 73.63. The calculations are shown in Table 13-2.

ACCIDENT SUMMARY

SITE NUMBER 13

ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
2	2		

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
1		1	1			1

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
						1	1				1

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
									1		1					1						1	

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day-light	Dark	Dawn	Dusk
3	1		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
2	1	1		

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
3	1		

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side-swipe	Non-Col	Head-on	Backing
2		1	1						

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right-of-Way	Improper Passing	Improper Backing	Improper Turning	Other
1	1		1			1		

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
1	1		
1	1		

Injury
Fatality
Property
Dam. Only

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

1

TABLE 13-2
HAZARD INDEX CALCULATION

Site Number 13 Date _____

Site Description Foothill Road - Curve

Indicator	Data Value		Indicator Value		Weight		Partial H.I.s
No. of Accidents	<u>1.0</u>	acc/yr	<u>25</u>	X	0.164	=	<u>4.10</u>
Accident Rate	<u>21.07</u>	acc/MVE	<u>100</u>	X	0.225	=	<u>22.50</u>
Accident Severity	<u>14,800</u>	dollars	<u>73</u>	X	0.191	=	<u>13.94</u>
Volume/Capacity Ratio	<u>0.05</u>		<u>18</u>	X	0.082	=	<u>1.48</u>
Sight Distance Ratio	<u><.50</u>	(wt.avg.)	<u>100</u>	X	0.074	=	<u>7.40</u>
Driver Expectancy	<u>4</u>	(wt.avg.)	<u>66</u>	X	0.149	=	<u>9.83</u>
Information System Deficiencies	<u>4</u>	(wt.avg.)	<u>66</u>	X	0.115	=	<u>7.59</u>

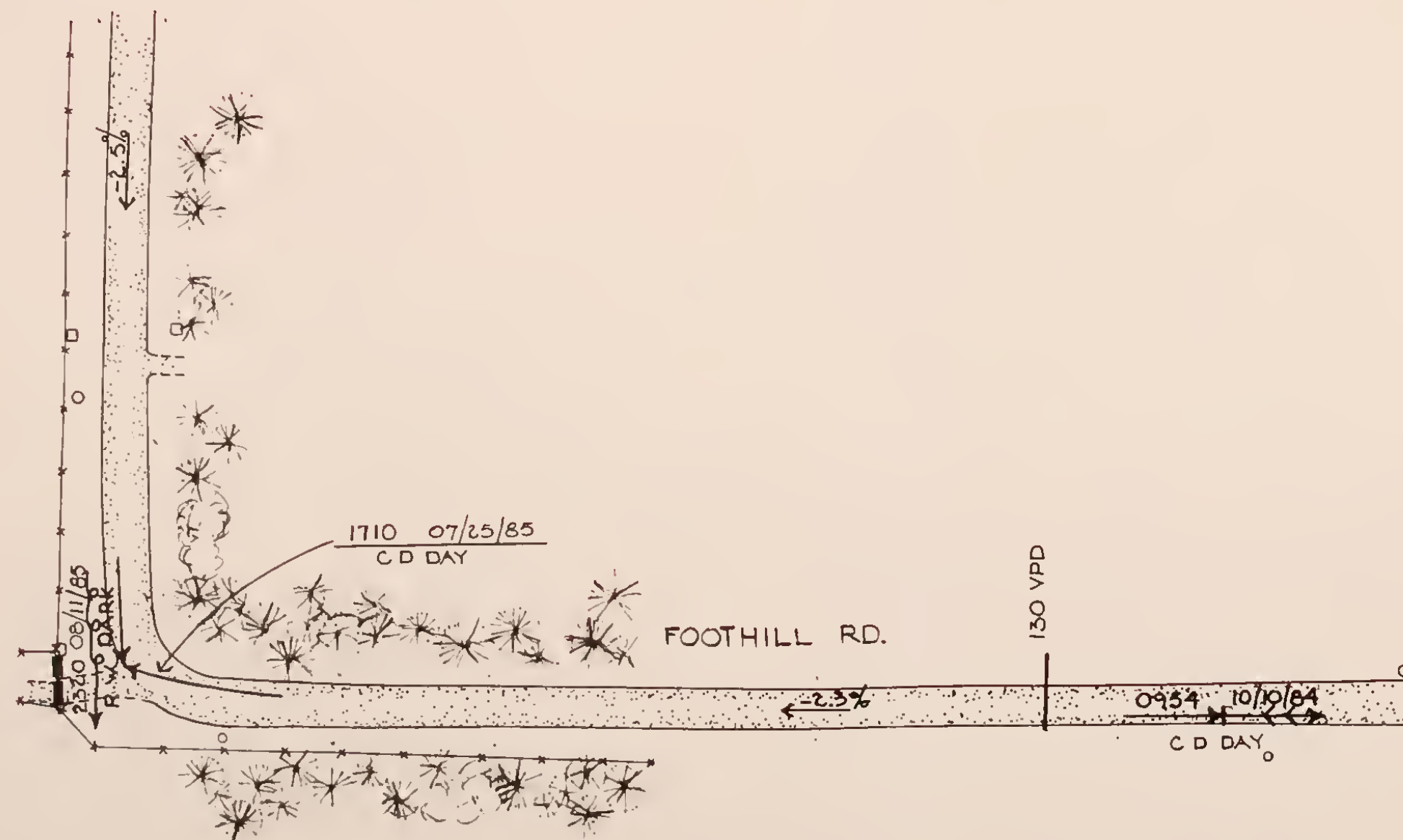
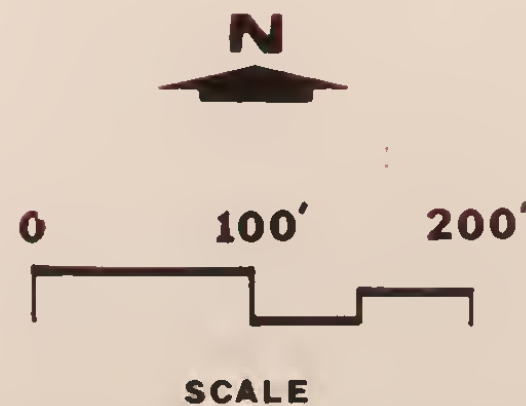
Hazard Index: 66.84

Cost of Recommended Improvements: \$660.00

Cost Factor: 94

Priority Index = Hazard Index x .75 + Cost Factor x .25

$$\underline{66.84} \times .75 + \underline{94} \times .25 = \underline{73.63}$$



SYMBOLS	
	Moving Vehicle
	Backing Vehicle
	Pedestrian Path
	Parked Vehicle
	Fixed Object
	Fatal Accident
	Injury Accident

COLLISION TYPES	
	Rear End
	Head On
	Side Swipe
	Out of Control
	Left Turn
	Right Angle

CONDITIONS	
WEATHER:	
F=Fog C=Clear R=Rain	
S=Snow SL=Slush	
SURFACE: O=Dry W=Wet I=Icy	
TIME → 1600 7/2/82 ← DATE	
WEATHER → C D ← DARK ← LIGHT	
	SURFACE

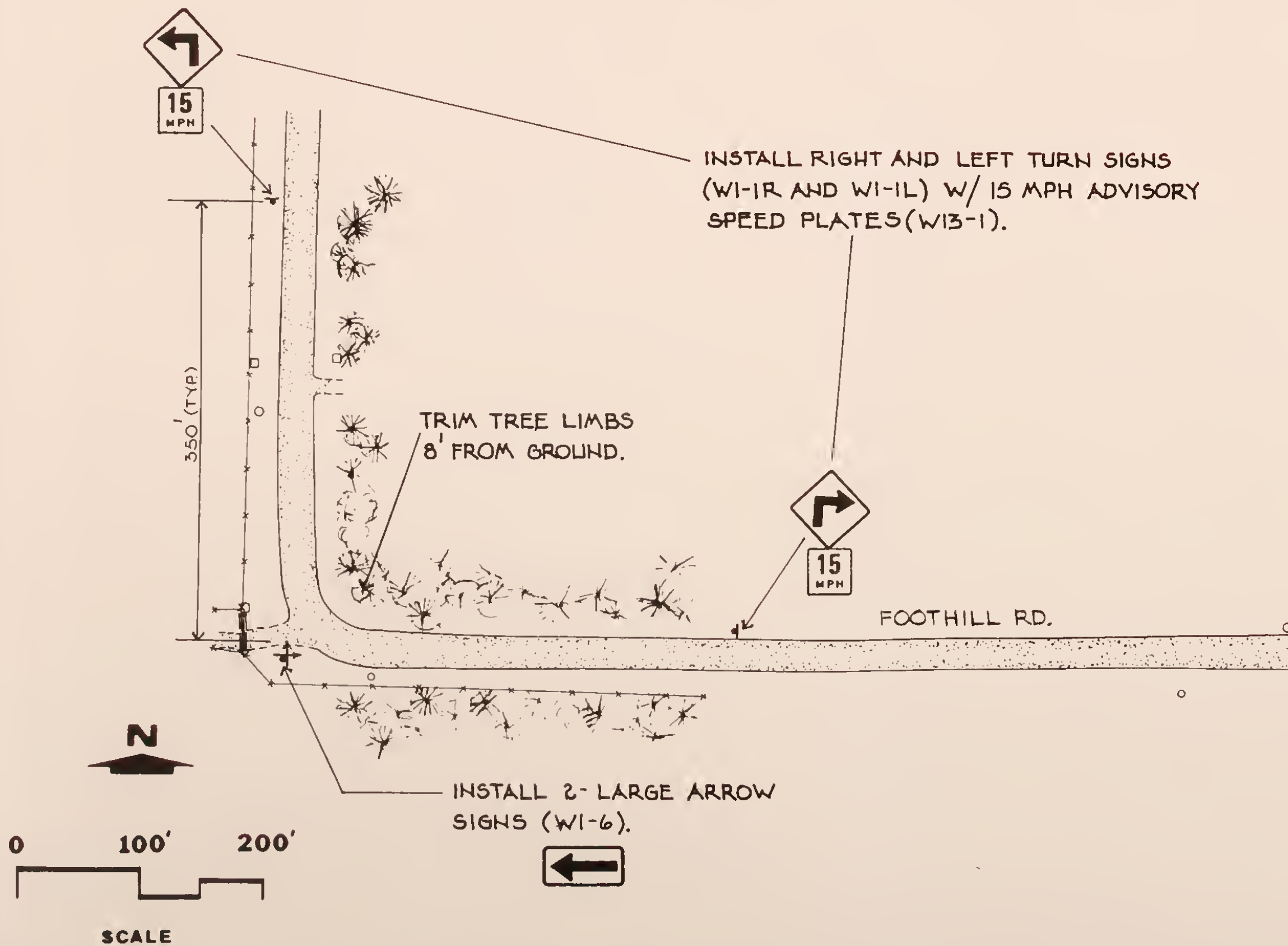
Existing Conditions & Accidents

SITE NO. 13
FLATHEAD COUNTY, MT.

Foothill Road

Fig. No.

13-1



Recommended Improvements

SITE NO. 13
FLATHEAD COUNTY, MT.

Foothill Road

Fig. No.

13-2

SITE NO.14
.....



Site 14 North Approach



Site 14 East Approach

SITE NO. 14

HILLTOP ROAD - CURVE

COLUMBIA FALLS

A. DESCRIPTION

This site is a 90-degree curve on Hilltop Road located approximately 1/2 mile southwest of the Columbia Falls city limits. The site is located in Section 13, Range 21 West, Township 30 North. Turn signs are located on the east and south approaches.

The 1988 average daily traffic at this site is 345 vpd.

The existing site characteristics are shown on Figure 14-1.

B. ACCIDENT ANALYSIS

Four accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

* Three of the accidents were single vehicles leaving the roadway.

- * All accidents involved southbound vehicles.
- * Three of the accidents occurred during dry road conditions.
- * Three accidents occurred during daylight hours.
- * All four accidents involved possible speed violations.
- * One accident was alcohol-related.
- * Two of the accidents involved a collision with the large tree located inside the curve.
- * The investigating officers' analysis attributed all four accidents to inexperience.
- * Alcohol was involved in one of the accidents.

Accident diagrams are shown on Figure 14-1. Table 14-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. The curve was ball banked at 25 MPH.
2. All accidents at this site involved westbound vehicles. Some of the roadway characteristics when approaching the curve in this direction are: a) steep downhill grade (4.7 percent); b) gravel tracked onto pavement from driveway located on the northwest side of the curve; and c) superelevation of 0.10 on curve.

D. RECOMMENDATIONS

The following improvements are recommended for this site:

1. Add 25 MPH advisory speed plates (W13-1) to the existing turn signs (W1-1R and -1L) on the east and south approaches.
2. Install two large arrow signs (W6-1) on the northwest side of the curve (Figure 14-2).

The recommended improvements are shown in Figure 14-2.

Long-Term Improvement

Pave driveway approach on the northwest side of the curve.

E. COST

- | | | |
|----|--|---------------|
| 1. | Add 25 MPH advisory speed plates (W13-1) to
existing turn signs | \$200.00 |
| 2. | Install two large arrow signs (W6-1) | <u>280.00</u> |

TOTAL COST	\$480.00
------------	----------

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 59.38. The priority index is 69.28. The calculations are shown in Table 14-2.

ACCIDENT SUMMARY

SITE NUMBER 14 ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
	2	2	

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
1	2			1		

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
				2					1		1

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
							1		1											1		1	

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day- light	Dark	Dawn	Dusk
3	1		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
3			1	

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
4			

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side- swipe	Non-Col	Head- on	Backing
			2			1	1		

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right- of-Way	Improper Passing	Improper Backing	Improper Turning	Other
			4					

NUMBER OF ACCIDENTS BY SEVERITY

Injury
Fatality
Property
Dam. Only

1984	1985	1986	1987
	1	1	
	1	1	

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

1

TABLE 14-2
HAZARD INDEX CALCULATION

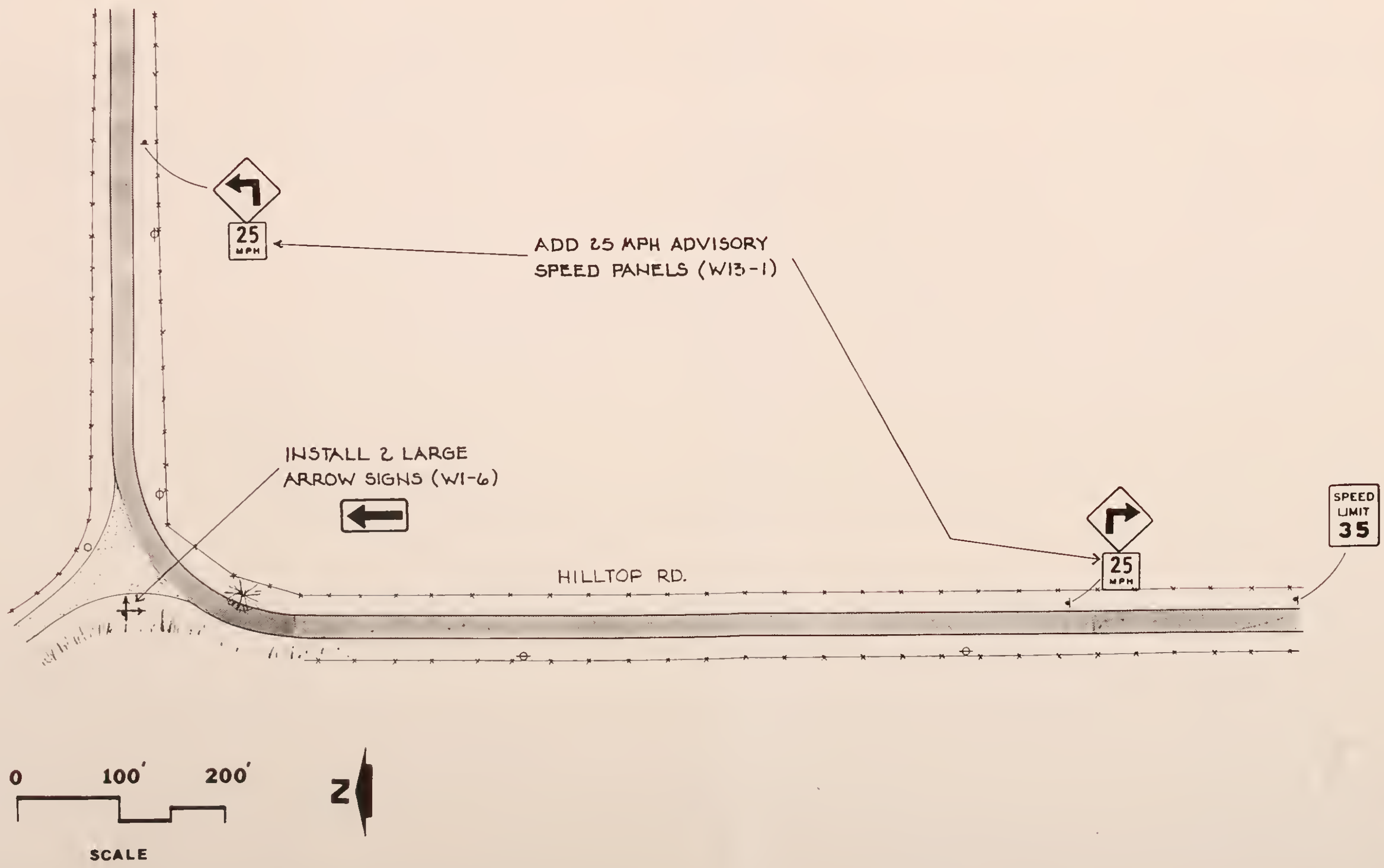
Site Number 14 Date _____

Site Description Hilltop Road - Curve - Columbia Falls

Indicator	Data Value		Indicator Value		Weight		Partial H.I.s
No. of Accidents	<u>1.0</u>	acc/yr	<u>25</u>	X	0.164	=	<u>4.10</u>
Accident Rate	<u>7.94</u>	acc/MVE	<u>89</u>	X	0.225	=	<u>20.02</u>
Accident Severity	<u>6,800</u>	dollars	<u>53</u>	X	0.191	=	<u>10.12</u>
Volume/Capacity Ratio	<u>0.14</u>		<u>31</u>	X	0.082	=	<u>2.54</u>
Sight Distance Ratio	<u>0.66</u>	(wt.avg.)	<u>70</u>	X	0.074	=	<u>5.18</u>
Driver Expectancy	<u>4</u>	(wt.avg.)	<u>66</u>	X	0.149	=	<u>9.83</u>
Information System Deficiencies	<u>4</u>	(wt.avg.)	<u>66</u>	X	0.115	=	<u>7.59</u>
Hazard Index:							<u>59.38</u>
Cost of Recommended Improvements:							<u>\$480.00</u>
Cost Factor:							<u>99</u>

Priority Index = Hazard Index x .75 + Cost Factor x .25

$$\underline{59.38} \times .75 + \underline{99} \times .25 = \underline{69.28}$$



SITE NO.15
.....



Site 15 East Approach



Site 15 North Approach



Site 15 Midcurve-Looking West



Site 15 North Approach

SITE NO. 15

McCAFFERY ROAD - CURVE

A. DESCRIPTION

This site is located at a curve on McCaffery Road approximately 1.25 miles west of its intersection with Echo Lake Road. The site is located in Section 7, Range 19 West, Township 27 North. The road has a gravel surface. The roadway curves around a hill with a steep slope on the inside of the curve. There is a steep slope on the outside of the curve.

The 1988 average daily traffic at this site is 45 vpd.

The existing site characteristics are shown on Figure 15-1.

B. ACCIDENT ANALYSIS

Two accidents occurred at this site during the four-year period from 1984 through 1987. The following is a summary of characteristics that are pertinent in determining factors that may have contributed to the accidents:

- * One accident was after dark and one during daylight hours.
- * The road was dry when both accidents occurred.
- * Both accidents were the result of a single vehicle leaving the road.
- * One accident was possibly caused by deer on the road.
- * Both were injury accidents.
- * The investigating officers' analysis attributed both accidents to alcohol.

Accident diagrams are shown on Figure 15-1. Table 15-1 summarizes accident characteristics at the site.

C. EVALUATION

The following factors pertaining to the site were determined from the field survey and accident analysis:

1. The curve was ball banked at 15 MPH.

2. The curve is shaded by large trees. The steep slope on the inside of the curve limits sight distance from both approaches.
3. The steep slope and narrow shoulder on the outside of the curve leaves very little recovery room for southbound vehicles swinging wide on the turn.

D. RECOMMENDATIONS

The following improvements are recommended for this site:

1. Install right- and left-turn signs (W1-1R and -1L) with 15 MPH advisory speed plates (W13-1) on the east and north approaches to the curve.
2. Install two large arrow signs (W1-6) on the west side of the curve (Figure 15-2).
3. Install 13 six-foot flexible delineators spaced as shown on Figure 15-2.

The recommended improvements are shown in Figure 15-2.

E. COST

1.	Install right- and left-turn signs (W1-1R and W1-1L) with 15 MPH advisory speed plates (W13-1)	\$280.00
2.	Install two large arrow signs (W6-1)	280.00
3.	Install 13 6-ft. flexible delineators	<u>260.00</u>
TOTAL COST		\$820.00

F. HAZARD AND PRIORITY INDICES

Based on the information collected and the foregoing analysis, the hazard index for this location is determined to be 64.27. The priority index is 68.45. The calculations are shown in Table 15-2.

ACCIDENT SUMMARY

SITE NUMBER 15

ACCIDENT PERIOD 1984-1987

NUMBER OF ACCIDENTS
BY YEAR

1984	1985	1986	1987
1	1		

NUMBER OF ACCIDENTS BY DAY OF WEEK

Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
		1				1

NUMBER OF ACCIDENTS BY MONTH

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
				1					1		

-- AM --

NUMBER OF ACCIDENTS BY TIME OF DAY

-- PM --

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
																1							1

NUMBER OF ACCIDENTS
BY LIGHT CONDITIONS

Day-light	Dark	Dawn	Dusk
1	1		

NUMBER OF ACCIDENTS
BY ROAD CONDITIONS

Dry	Wet	Snow	Ice	Other
2				

NUMBER OF ACCIDENTS
BY WEATHER CONDITIONS

Clear	Rain	Snow	Fog
1	1		

NUMBER OF ACCIDENTS BY ACCIDENT TYPE

Angle	Turn	Rear End	Fixed Object	Ped.	Animal	Side-swipe	Non-Col	Head-on	Backing
			1		1				

NUMBER OF ACCIDENTS BY POSSIBLE VIOLATION

No Violat.	Drinking	Reckless Driving	Speed	Right-of-Way	Improper Passing	Improper Backing	Improper Turning	Other
1	1							

NUMBER OF ACCIDENTS BY SEVERITY

1984	1985	1986	1987
1	1		

NUMBER OF ACCIDENTS
ALCOHOL INVOLVED

1

Injury
Fatality
Property
Dam. Only

TABLE 15-2
HAZARD INDEX CALCULATION

Site Number 15 Date _____

Site Description McCaffery Road - Curves

Indicator	Data Value		Indicator Value		Weight		Partial H.I.s
No. of Accidents	<u>0.50</u>	acc/yr	<u>18</u>	X	0.164	=	<u>2.95</u>
Accident Rate	<u>30.44</u>	acc/MVE	<u>100</u>	X	0.225	=	<u>22.50</u>
Accident Severity	<u>12,400</u>	dollars	<u>69</u>	X	0.191	=	<u>13.18</u>
Volume/Capacity Ratio	<u>0.02</u>		<u>10</u>	X	0.082	=	<u>0.82</u>
Sight Distance Ratio	<u><.50</u>	(wt.avg.)	<u>100</u>	X	0.074	=	<u>7.40</u>
Driver Expectancy	<u>4</u>	(wt.avg.)	<u>66</u>	X	0.149	=	<u>9.83</u>
Information System Deficiencies	<u>4</u>	(wt.avg.)	<u>66</u>	X	0.115	=	<u>7.59</u>

Hazard Index: 64.27

Cost of Recommended Improvements: \$780.00

Cost Factor: 81

Priority Index = Hazard Index x .75 + Cost Factor x .25

$$\underline{64.27} \times .75 + \underline{81} \times .25 = \underline{68.45}$$

ADDITIONAL SITES

1981 HIGH HAZARD LOCATION STUDY

A. DESCRIPTION

The following sites were evaluated in the 1981 High Hazard Location Study. Due to continued accident clusters at these locations, a field inspection was conducted. The locations have been ranked along with the sites studied in 1988. It is recommended that the 1981 improvements be implemented. The cost of these improvements and materials required have been included in the improvement priority list and summaries of materials. Costs are based on current "Work at Agreed Price" rates of the Montana Dept. of Highways.

The following summarizes the improvements and costs for each of the 1981 accident sites:

SITE NO. 15-81

COLUMBIA FALLS STAGE ROAD AT RED BRIDGE

COST

1.	Install 13 6-ft. flexible delineators	\$260.00
2.	Install One-Lane Bridge sign (W5-3)	140.00
3.	Install two Curve signs (W1-2)	280.00
4.	Install two large arrows (W1-6)	<u>280.00</u>

TOTAL	\$960.00
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SITE NO. 20-81

BIG MOUNTAIN ROAD, UPPER SWITCHBACK

COST

1.	Install two curve signs (W1-5a)	\$280.00
2.	Install two hinged Icy Road signs (W8-10)	280.00
3.	Install 16 6-ft. flexible delineators	320.00

4.	Install 4 No Parking signs (R8-3)	<u>400.00</u>
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TOTAL		\$1,280.00
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SITE NO. 21-81

EAST LAKE SHORE DRIVE AT HELL ROARING CREEK

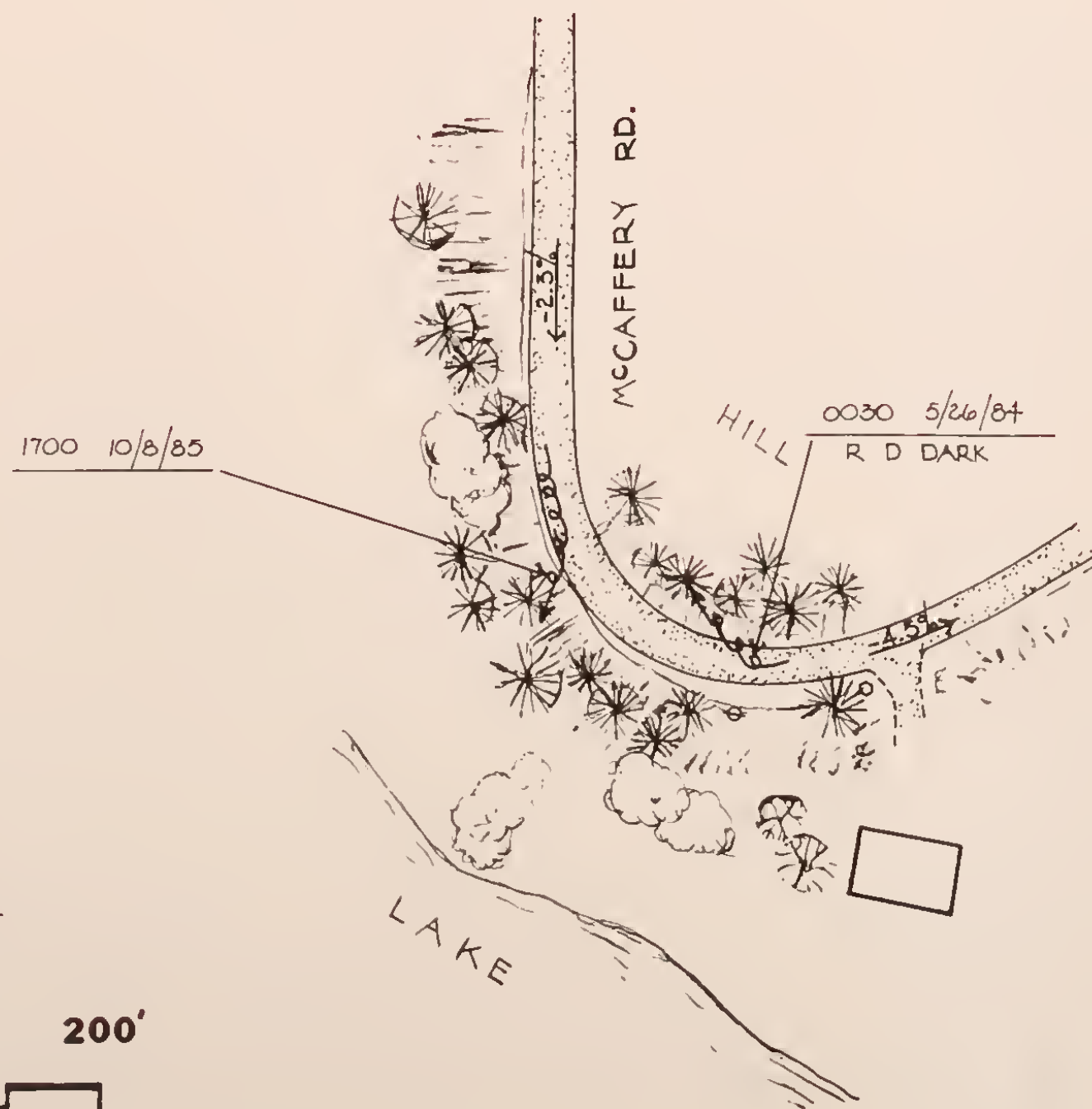
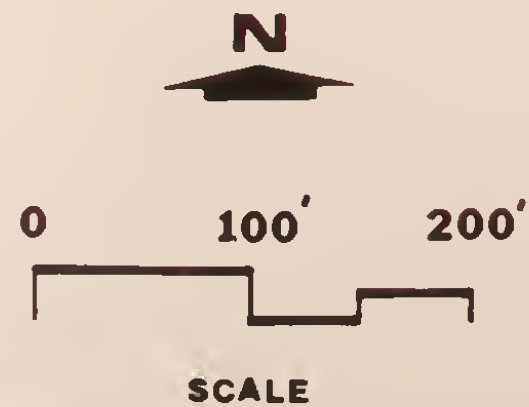
COST

1.	Install 24 chevron signs (W1-8)	\$2,400.00
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2.	Install 2 winding road signs (W1-5)	<u>280.00</u>
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TOTAL		\$2,680.00
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Plans for the foregoing improvements are shown in the 1981 High Hazard Location Study prepared by Robert Peccia & Associates.



SYMBOLS	
	Moving Vehicle
	Backing Vehicle
	Pedestrian Path
	Parked Vehicle
	Fixed Object
	Fatal Accident
	Injury Accident

COLLISION TYPES	
	Rear End
	Head On
	Side Swipe
	Out of Control
	Left Turn
	Right Angle

CONDITIONS	
WEATHER: F=Fog C=Clear R=Rain S=Snow SL=Sleet	
SURFACE: D=Dry W=Wet I=Icy	
TIME → 1600 7/2/82 ← DATE	
WEATHER → C D ← LIGHT	
	SURFACE

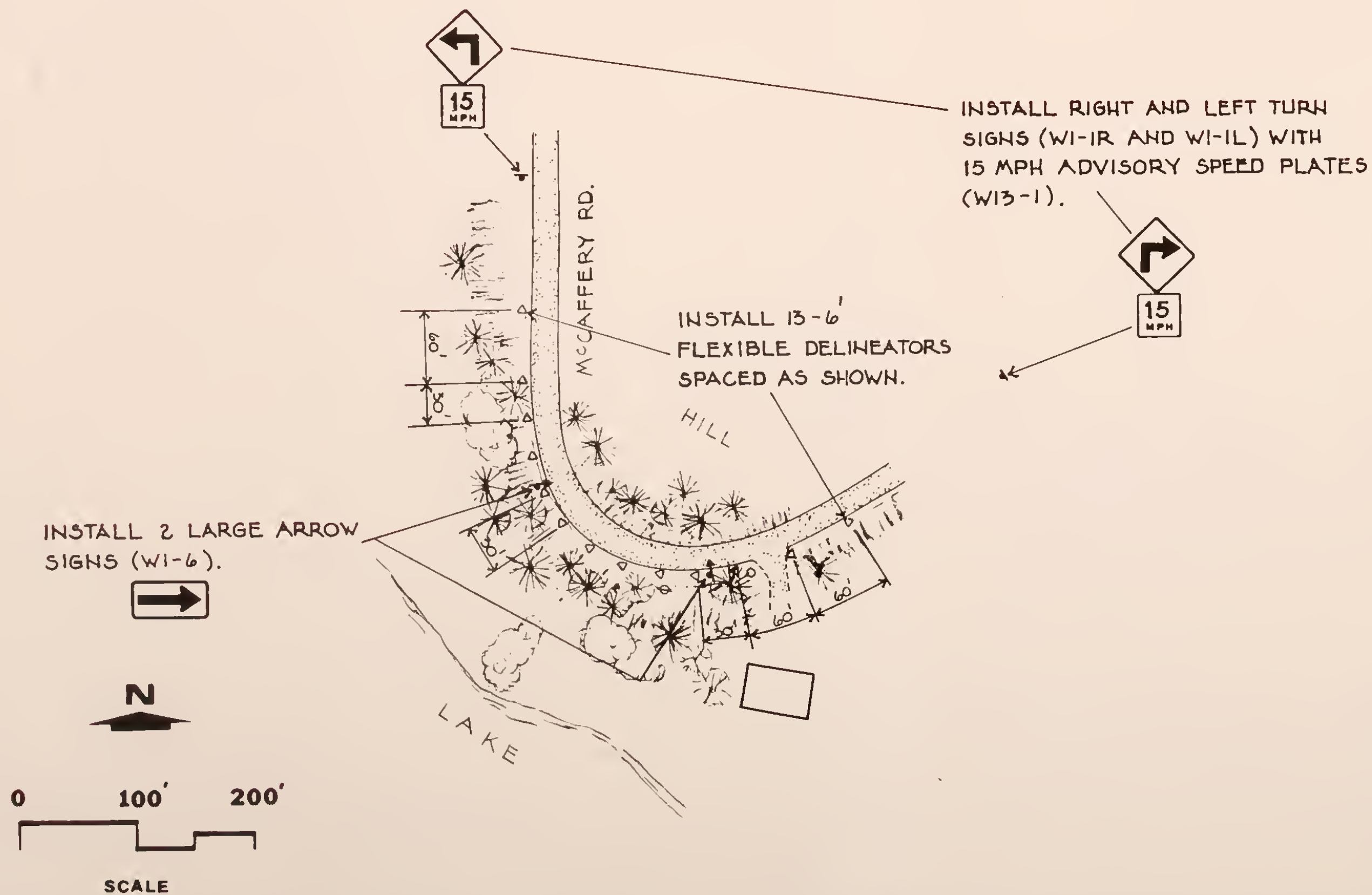
Existing Conditions & Accidents

SITE NO. 15
FLATHEAD COUNTY, MT.

McCaffery Road

Fig. No.

15-1



SITE NO. 15 **FLATHEAD COUNTY, MT.**

Recommended Improvements

McCaffery Road

Fig. No.

15-2

Consultant Staff:

Clete Daily - Project Engineer

Bruce Wade - Site Surveys

Jim McGowan - Graphics, Mapping

Gayle Parrish - Word Processing

